RALEIGH STREET DESIGN MANUAL

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STREET DESIGN MANUAL

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Section 1 – INTRODUCTION

1.1 Purpose and Scope

This Manual was developed in conjunction with the Unified Development Ordinance, which recognizes the critical link between land use and transportation, insuring that both work together to preserve and create great places within the City of Raleigh.

In the case where any requirement in the City of Raleigh Code conflicts with any regulation or standard presented in this manual, the City of Raleigh Code shall control.

The design guidelines contained in this Manual are intended to provide for adequate and coordinated development with necessary facilities to serve and protect all users of Raleigh's transportation system.

It is recognized that certain improvements financed wholly or in part with State and Federal funds are subject to the regulations and standards prescribed by those agencies. Such regulations and standards may be different than those of the City and may take priority over City regulations and standards presented in this manual. The guidance presented herein is based on nationally-accepted design parameters:

AASHTO's *A Policy on the Geometric Design of Highways and Streets* and *Flexibility in Highway Design*, and supplemented by context-specific guidance such as that contained in the joint ITE/CNU *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*.

The Public Works Director, or his/her designee thereafter referred to as the Public Works Director, in consultation with other City departments and state agencies, may in accordance with Sec. 10.2.18 of the Unified Development Ordinance, approve design adjustment for identified regulations established in Chapter 8 of the Unified Development Ordinance.

Section 2 – STREETS FOR ALL USERS

2.1 Introduction

As defined in Raleigh's Unified Development Ordinance, there are many street typologies to work with various streetscapes and frontage types. While the UDO informs the design professional as to the appropriate street typology, this manual assists with specific design direction related to the engineering aspects of the various street typologies.

It is the responsibility of the developer to take future roadway plans of the City and NCDOT into consideration when developing a site plan for a future development. Sources of information include, but are not limited to:

- City of Raleigh Thoroughfare Map of the Comprehensive Plan
- NCDOT Transportation Improvement Program (TIP)
- Capital Improvement Plan (CIP)
- City of Raleigh and Wake County Short and Long Range Transit Plans
- Metro Transportation Plan

In addition, consideration of developments in the immediate vicinity should also be taken into consideration to address existing development patterns and context.

2.2 Complete Streets and Context Sensitive Streets

In 2009, NCDOT adopted a Complete Streets Policy. The Policy Statement is cited for reference below:

> *Transportation, quality of life, and economic development are all undeniably connected through well-planned, well-designed, and context sensitive transportation solutions. To NCDOT, the designations "well-planned", "well-designed" and "context-sensitive" imply that transportation is an integral part of a comprehensive network that safely supports the needs of the communities and the traveling public that are served.*
>
> *The North Carolina Department of Transportation, in its role as stewards over the transportation infrastructure, is committed to:*
>
> - *Providing an efficient multi-modal transportation network in North Carolina such that the access, mobility, and safety needs of motorists, transit users, bicyclists, and pedestrians of all ages and abilities are safely accommodated;*
> - *Caring for the built and natural environments by promoting sustainable development practices that minimize impacts on natural resources, historic, businesses, residents, scenic and other community values, while also recognizing that transportation improvements have significant potential to contribute to local, regional, and statewide quality of life and economic development objectives;*
> - *Working in partnership with local government agencies, interest groups, and the public to plan, fund, design, construct, and manage complete street networks that sustain mobility while accommodating walking, biking, and transit opportunities safely.*
>
> *This policy requires that NCDOT's planners and designers will consider and incorporate multimodal alternatives in the design and improvement of all appropriate transportation projects within a growth area of a town or city unless exceptional circumstances exist. Routine maintenance projects may be excluded from this requirement; if an appropriate source of funding is not available.*

The City of Raleigh supports that Complete Streets are an important aspect of the quality of life in the City, and has therefore developed a palette of street typologies that accommodate all users within the context of the UDO. While the street typologies adhere to the principles of Complete Streets, some place more emphasis on moving vehicular traffic than others. Context and frontage type strongly dictate the balance between various modes of transportation.

The sections contained herein were developed concurrently and in coordination with NCDOT's Complete Streets Policy; however, in some instances, they may vary somewhat from the NCDOT sections in order to be consistent with a certain land use or development typology context.

2.3 Process of Street Design

In using this Manual to assist in the design of transportation systems for the City of Raleigh, it is important to recognize the overall goal of implementing transportation systems within the City. Streets shall be designed to be consistent and supportive of their context, serving all modes of mobility which occur within that context in a safe and efficient manner.

2.4 Raleigh Standard Street Typologies

The street typologies, their primary functions and elements are defined herein. Typical cross-sections are depicted with acknowledgement that there may be appropriate modifications to the preferred cross-sections and dimensions, may be approved. Any deviations from the required dimensions must be approved by the Public Works Director as a Design Adjustment.

These street typologies are included in the UDO; however, this Manual includes the typologies with additional engineering and technical specifications.

Section 3 – Street Element Overview

Within the right-of-way, there are two primary zones: the Streetscape and the Travelway, which address the treatment of access and movement, respectively. The elements included within each zone are defined in the street cross sections with more extended descriptions and guidelines located in following Section 4 of this manual.

3.1 Streetscape

The Streetscape is the primary pedestrian realm, accommodating people walking, stopping, and sitting, and also functions as the transitional area between moving traffic and land uses. The streetscape is also the place where transitions between modes occur and thus its design characteristics are important in providing landscaping, aesthetics, multimodal accessibility and transportation components. The streetscape is located on both sides of the travelway. More on Streetscapes can be found in Section 6.18 under Streetscape Design and Operations

3.2 Travelway

The travelway refers to the paved width of a street between curbs which accommodates moving and stationary vehicles in a variety of modes. On wider street cross-sections, additional landscaping such as medians may be present to provide safe havens for crossings, traffic calming, drainage, and other beneficial functions. The travelway may include the following elements:

- General Travel Lane: General travel lanes accommodate vehicles of all types. The design and control for the general travel lane determine the width of the lane(s) and the street, as well as other geometrics such as curb radii. The width of the travel lane is directly corresponds with the operating speed of the street and the level of mobility and access. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- Bicycle Facility: Bicycles may be accommodated in their own space or in a shared lane with other vehicles in the ROW. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- Transit Facility: Buses, streetcars, taxis, and other mass transit vehicles may be accommodated in their own space or in a shared lane with other vehicles in the ROW. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- On-Street Parking: Parking within the ROW, typically adjacent to a curb, accommodates automobiles, bicycles or other vehicles. Parallel orientation is most common, though angled (head in and back in) parking may be used to provide additional spaces where sufficient ROW exists and off-street parking capacity is very limited. The presence of on-street parking encourages lower vehicular travel speeds on streets. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- Gutter and/or Shoulder: The choice between gutter and shoulder depends primarily on area drainage characteristics, environmental sensitivity, land use intensity, and aesthetic intent. For most street typologies, a cross-section supporting more urban development applies the use of curb and gutter. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- Median: Medians can range in width depending on street typology and context. They may accommodate integrated turn lanes, pedestrian refuges at cross-streets and mid-block, drainage swales, shade trees, promenades transit lines and stations. If space permits, landscaped medians provide a beneficial aesthetic and street narrowing effect in almost any context. Specific types of facilities and the situations in which they are most appropriate are discussed in Section 5.

- Turn Lane: Turn lanes may be continuous, integrated with spot medians, or installed at intersections with high vehicular turning volume. Where center left turn lanes are provided on streets with four or more general travel lanes, medians with a pedestrian refuge may be added to aid in safe crossing as well as more efficient traffic signal phasing. Specific types of facilities and the situations in which they are most appropriate are discussed in chapter 6.

3.3 Roadway Classification Design Vehicle Type

The following vehicle types have been used in the engineering specifications for each street type.

Table 2.

Street Typology	Design Vehicle
Alley	Single Unit Truck (SU-30)
Local Streets	Passenger Car (P) or Single Unit Truck (SU-30)
Mixed Use Streets	Single Unit Truck (SU-30)
Major Streets	Intermediate Semi-Trailer (WB-40) or Interstate Semi-Trailer (WB-62)
Industrial Streets	Interstate Semi-Trailer (WB-62)

Section 4 – Street Types Overview

4.1 Sensitive Area Streets

4.1.1 Sensitive Area Parkway
4.1.2 Sensitive Area Avenue
4.1.3 Sensitive Area Residential Street

4.2 Local Street

4.2.1 Neighborhood Yield
4.2.2 Neighborhood Local
4.2.3 Neighborhood Street
4.2.4 Multifamily Street

4.3 Mixed Use Streets

4.3.1 Avenue 2-Lane, Undivided
4.3.2Avenue 2-Lane, Divided

4.1 Sensitive Area Streets

In areas of Raleigh where stormwater and wastewater do not feed into sewers, other forms of drainage must be provided. Along encompassed streets, open channel drainage ditches are typical and must be accommodated within special cross-sections. The following roadway cross-sections are intended for use in these “Sensitive” areas: Parkway, Avenue, and Sensitive Area Residential Street.

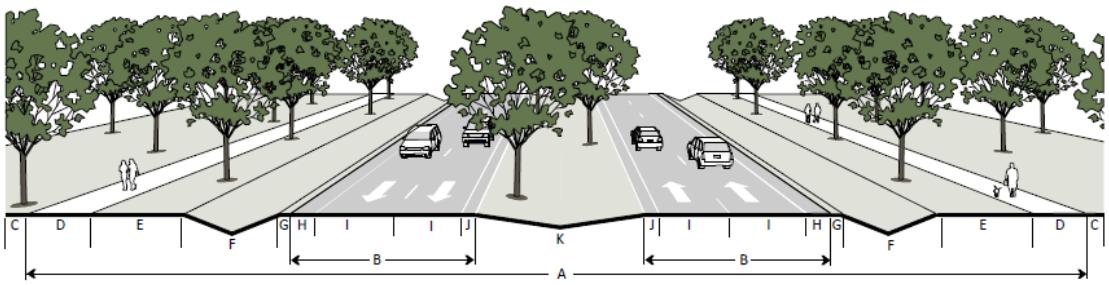
Sensitive Parkways are semi-limited access corridors, and are often used to preserve scenic views. They are intended primarily to support regional travel. Medians are a standard feature of parkways in almost every case, except where a narrower cross-section is needed to minimize right-of-way and environmental impact.

Sensitive Avenues are for use in low-intensity areas that do not have sewer provisions. They have relatively narrow paved widths, which includes shoulders for bicycle and pedestrian uses in retrofit situations lacking sidewalks.

Sensitive Area Residential Streets are appropriate in rural or exurban conditions with large lot homes, without water and sewer provisions.

4.1.1 Sensitive Area Parkway

A sensitive area parkway would be most appropriate as a high volume regional connector road where surroundings are primarily conservation or agricultural land. A multi-use trail is a preferred way to accommodate long distance and recreational cyclists and joggers, though in limited circumstances where necessary for environmental reasons, wide (8') outside shoulders may be used instead. Ideally, both trails and shoulders are installed. Express transit service may be implemented on Sensitive Area Parkways.

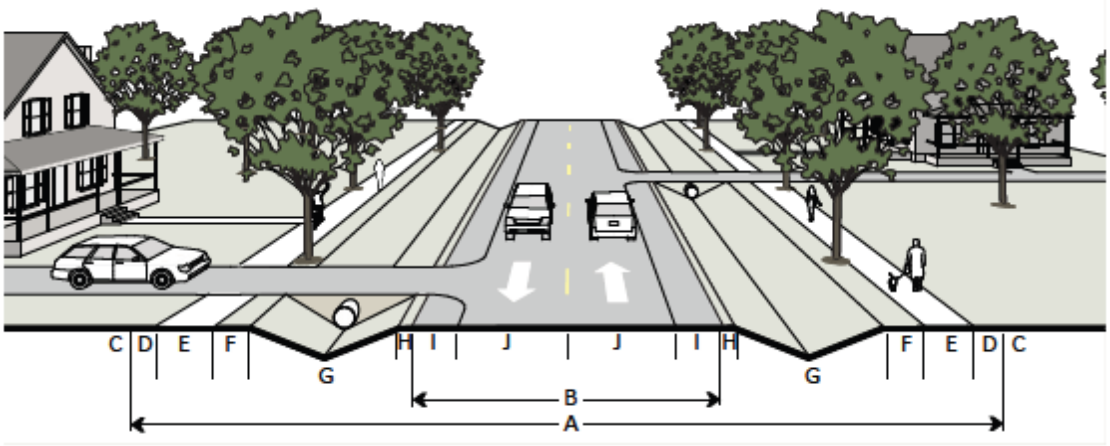


Width		
A	Right-of-way width	158'
B	Pavement width	32'
Streetscape		
C	Maintenance strip (min)	2'
D	Multi-use trail (min)	10'
E	Planting area (min)	6'
F	Drainage (min)	10'
Travelway		
G	Grassed shoulder	2'
H	Paved shoulder	8'
I	Travel lane	11'
J	Paved shoulder	2'
K	Median (min)	30'
General		
Walkway type		Multi-use path
Planting type		Tree lawn
Tree spacing		50' o.c. avg

Engineering Specifications	
Target Speed (mph)	50 mph
Design Speed (mph)	50 mph
Control Vehicle	WB-62
Design Vehicle	WB-62
Signalized Intersection Density	No more than 1 per mile
Driveway Spacing	1/4 mile, min
Median Opening Distance	At signals or 2 miles apart, minimum
Partial Medians/Island	Median must be continuous
Curb Radii	25' +
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Transit stop or trail amenities
Low Impact Development (LID)	Bioswales, permeable shoulders and/or Streetscape

4.1.2 Sensitive Area Avenue

A sensitive area avenue is used in rural and exurban conditions where it provides important connectivity for multiple travel modes. It should not be used in a completely residential setting (see "Sensitive Area Residential Street" instead.) The Sensitive Area Avenue typology provides great flexibility in accommodating future physical growth, and could be reconfigured to a "Main Street" cross-section within targeted development nodes if drainage facilities were upgraded.



Width		
A	Right-of-way width	80'
B	Pavement width	30'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	5'
F	Planting area (min)	6'
G	Drainage (min)	10'
Travelway		
H	Grassed Shoulder	2'
I	Paved Shoulder	4'
J	Travel lane	11'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		50' o.c. avg

Engineering Specifications	
Target Speed (mph)	30 mph
Design Speed (mph)	30 mph
Control Vehicle	WB-62
Design Vehicle	SU-30
Signalized Intersection Density	8/mile, maximum
Driveway Spacing	> 100' apart
Median Opening Distance	at intersections
Partial Medians/Island	Yes, optional
Curb Radii	15'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Bioswales, permeable pavement in shoulders

4.1.3 Sensitive Area Residential Street

Sensitive Area Residential Streets are installed in places where natural runoff water drainage is preferred, and traffic volume is relatively low. Typically this typology would be used in an agricultural or primarily low-density residential setting. A sidewalk shall be installed on one side of the street where the majority of origins and destinations exist.

Width		
A	Right-of-way width	70'
B	Pavement width	20'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	5'
F	Planting area (min)	6'
G	Drainage (min)	10'
Travelway		
H	Grassed Shoulder	2'
I	Travel lane	10'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		50' o.c. avg

Engineering Specifications	
Target Speed (mph)	20 mph
Design Speed (mph)	20 mph
Control Vehicle	SU-30
Design Vehicle	Passenger Vehicle
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Bioswales, Rain Gardens, permeable pavement

4.2 Local Streets

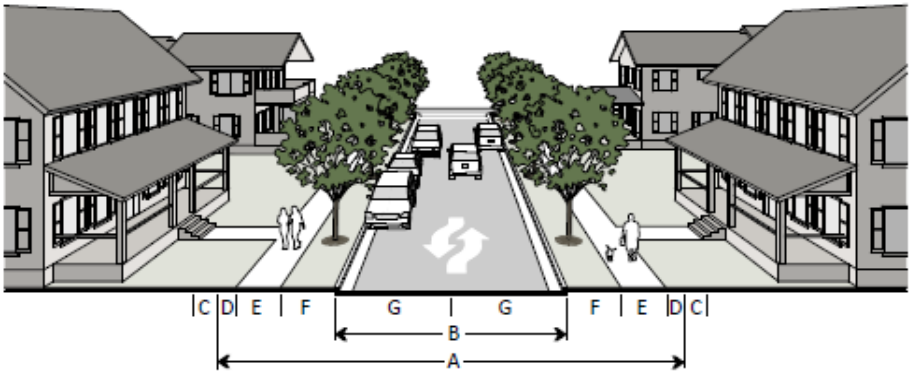
Local Streets provide access to individual lots, accommodate pedestrians and serve as low speed bicycle and vehicle routes. Local streets should be relatively short in total distance and used less frequently compared to other street typologies.

Every local street typology shall appropriately accommodate emergency vehicles.

4.2.1 Neighborhood Yield

Neighborhood Yield is unstriped two-way streets accommodating parallel parking on both sides. Narrower versions of this cross-section with parallel parking allowed on only one side may be used in an alley or real loaded development with high street network connectivity, as described in section 3.8. Neighborhood Yield streets operate best under low speed and volume conditions, giving opposing vehicle drivers the time and space necessary to successfully negotiate potential conflicting movements and serving no more than 40 units and no longer than ½ mile.

Continuous sidewalks are required on both sides of the street. Items in the amenities zone such as streetlights and trees should be installed at a pedestrian scale so as to provide a high level of comfort for residents and non-motorized street users.



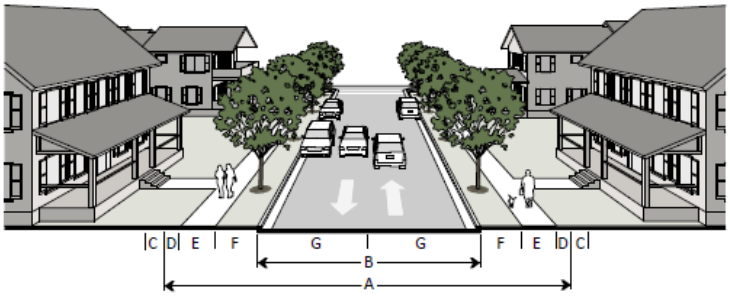
Width		
A	Right-of-way width	55'
B	Back-of-curb to back-of-curb	27'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'

Travelway		
G	Parallel parking/travel lane	13.5'
General		
Walkway type	Sidewalk	
Planting type	Tree lawn	
Tree spacing	40' o.c. avg	
Parking type	Parallel	

Engineering Specifications	
Target Speed (mph)	15 mph
Design Speed (mph)	15 mph
Control Vehicle	SU-30
Design Vehicle	Passenger Vehicle
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Rain Gardens, permeable pavement

4.2.2 Neighborhood Local

Neighborhood Local Streets are used in primarily residential developments serving from 40 and up to 150 residential units and no longer than ½ mile. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street, along with planting strips sufficient in width for shade trees.

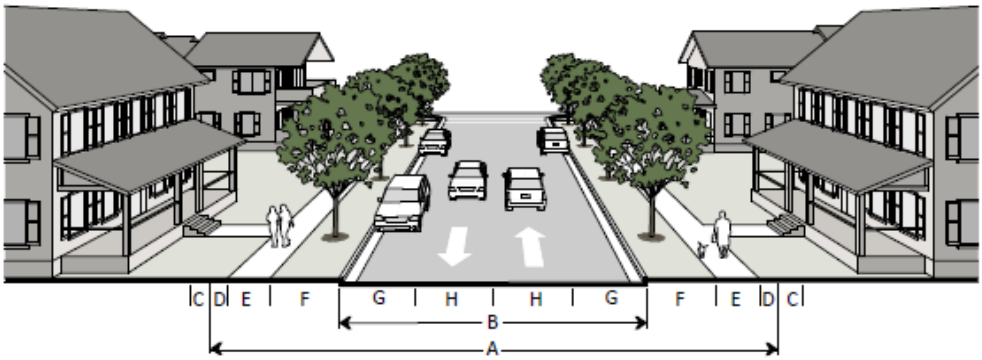


Width		
A	Right-of-way width	59'
B	Back-of-curb to back-of-curb	31'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Parallel parking/travel lane	15.5'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg
Parking type		Parallel

Engineering Specifications	
Target Speed (mph)	20 mph
Design Speed (mph)	20 mph
Control Vehicle	SU-30
Design Vehicle	Passenger Vehicle
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Rain Gardens, permeable pavement in parking area (6' from curb face)

4.2.3 Neighborhood Street

Neighborhood Streets are used primarily in areas serving between 150 and up to 350 residential units and also where residential uses may be compatible with non-residential uses in a mixed-use context. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street, along with amenity zones with shade trees. Traffic calming design elements such as intersection bulb-outs can help to moderate vehicle speeds on Neighborhood Streets.

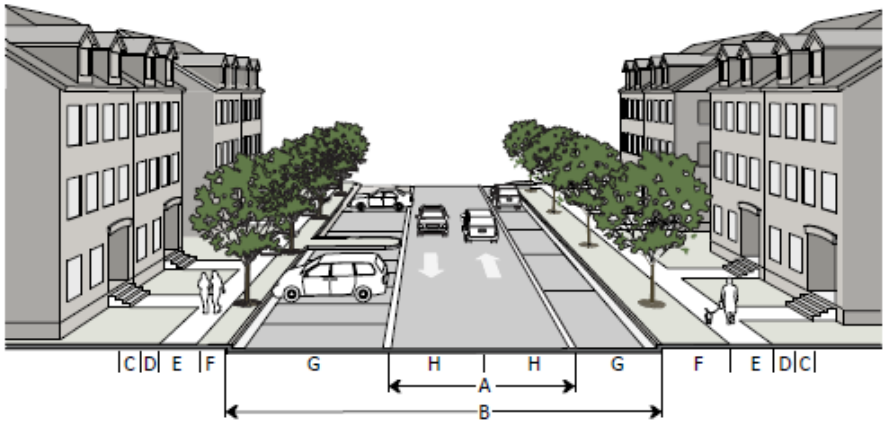


Width		
A	Right-of-way width	64'
B	Back-of-curb to back-of-curb	36'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Parallel parking lane	8'
H	Travel lane	10'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg
Parking type		Parallel

Engineering Specifications	
Target Speed (mph)	25 mph
Design Speed (mph)	25 mph
Control Vehicle	SU-30
Design Vehicle	Passenger Vehicle
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters
Low Impact Development (LID)	Rain Gardens, Planters

4.2.4 Multifamily Street

Multi-Family Local Streets are intended to provide direct lot access and a relatively high level of on-street parking capacity in residential (Apartments and Townhomes) settings. Two general travel lanes are present along with the allowance of a row of parking on either side in a parallel, perpendicular or angled configuration. Multi-family streets are to be used exclusively for residential developments built under the apartment or townhouse building types defined in the Unified Development Ordinance. Sidewalks are required on both sides of the street in a public easement. It is also necessary to have an adequate streetscape width to provide a buffer between pedestrians and the parking area. In these sections, the parking is not in the right of way.



Width		
A	Right-of-way width	22'
B	Back-of-curb to back-of-curb	49'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip, easement (min)	2'
E	Sidewalk, easement (min)	6'
F	Planting area (min)	6'
Travelway		
G	Parking lane Parallel (either side) Head-in (one side only) 60 deg angled either side	8' 18.5' 20’
H	Travel lane	10.5'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg

Engineering Specifications	
Target Speed (mph)	15 mph
Design Speed (mph)	15 mph
Control Vehicle	SU-30
Design Vehicle	Passenger Vehicle
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters
Low Impact Development (LID)	Rain Gardens, Permeable Pavement

4.3 Mixed Use Streets

Two general street typologies are listed under “Mixed Use Streets”: Avenues and Main Streets.

Avenues are walkable, low-speed thoroughfares, generally shorter in length than boulevards. They provide access to abutting commercial and mixed land uses as well as some residences. They serve as primary bicycle and pedestrian routes, and may accommodate local transit vehicles. Avenues may feature a median and on-street parking. In contexts without a frontage, on-street parking may be omitted. Mixed-use streets are also defined as collector streets in the UDO.

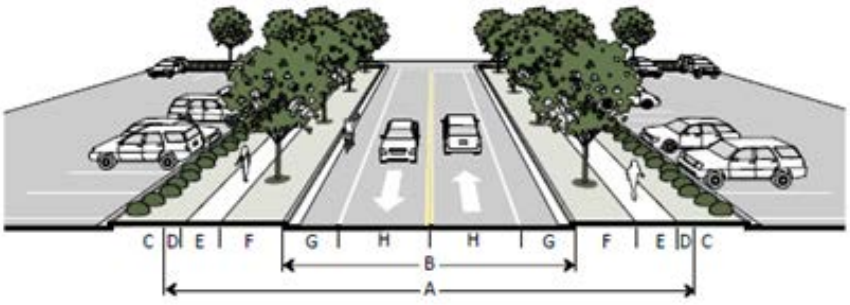
Main Streets are designed to provide connections between neighborhoods and districts, as well as providing access to Avenues and Boulevards from local streets. Main Streets are highly walkable and may serve as the primary street for commercial or mixed-use centers. On-street parking is typically provided.

Avenue 2-Lane (divided and undivided)

This typology is intended primarily for use in situations on roads directly adjacent to the Streetscape. The existing context may include any land use, but is often characterized by architecture such as strip malls, internally oriented subdivisions serving > 350 dwelling units with a middle turn lane, or detached development with large setbacks.

In recognition of the fact that this type of facility often plays a significant role in local multimodal mobility, the cross-section provides distinct general travel and bicycle lanes. For this type of street in particular, it is desirable to include a landscaped amenity zone of significant width in order to accommodate large street trees and mitigate stormwater runoff which can be an issue if frontage is dominated by parking lots as shown in this cross-section illustration.

<u>4.3.1 Avenue 2-Lane, Undivided</u>



Width		
A	Right-of-way width	64'
B	Back-of-curb to back-of-curb	36'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Bike lane	7'
H	Travel lane	11'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg

Engineering Specifications	
Target Speed (mph)	30 mph
Design Speed (mph)	30 mph
Control Vehicle	WB-40
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	> 100' apart
Median Opening Distance	> 200' apart
Partial Medians/Island	Optional
Curb Radii	15'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters, shelters,
Low Impact Development (LID)	Rain Gardens

4.3.2 Avenue 2-Lane, Divided

Width		
A	Right-of-way width With center turn lane With median	75' 79'
B	Back-of-curb to back-of-curb With center turn lane With median	48' 52'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Bike lane	7'
H	Travel lane	11'
I	Center lane Striped turn lane Median	11' 15'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg

Engineering Specifications	
Target Speed (mph)	30 mph
Design Speed (mph)	30 mph
Control Vehicle	WB-40
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	> 100' apart
Median Opening Distance	> 200' apart
Partial Medians/Island	Optional

Curb Radii	15'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters, shelters,
Low Impact Development (LID)	Rain Gardens

4.3.3 Avenue 3-Lane Parallel Parking

A three lane avenue with on-street parking and bike lanes offers significant flexibility. The cross-section is ideal to use in a context featuring residential uses with some ground floor commercial uses or in areas with a mixture of uses. This typology provides significant multimodal accessibility and mobility, yet maintains lower speeds and an appealing character, particularly when the center lane includes some landscaped median features.

Width		
A	Right-of-way width With center turn lane With median	90' 94'
B	Back-of-curb to back-of-curb With center turn lane With median	62' 66'
Streetscape		
C	Sidewalk (min)	8'
D	Planting area (min)	6'
Travelway		
E	Parallel parking lane	8.5'

F	Bike lane	6'
G	Travel lane	11'
H	Center lane Striped turn lane Median	11' 15'
General		
Walkway type	Sidewalk	
Planting type	Tree grate / lawn	
Tree spacing	40' o.c. avg	
Parking type	Parallel	

Engineering Specifications	
Target Speed (mph)	25 mph
Design Speed (mph)	25 mph
Control Vehicle	WB-40
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	> 100' apart
Median Opening Distance	> 200' apart
Partial Medians/Island	Optional
Curb Radii	10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters, shelters,
Low Impact Development (LID)	Rain Gardens

Main Street (parallel and angular Parking)

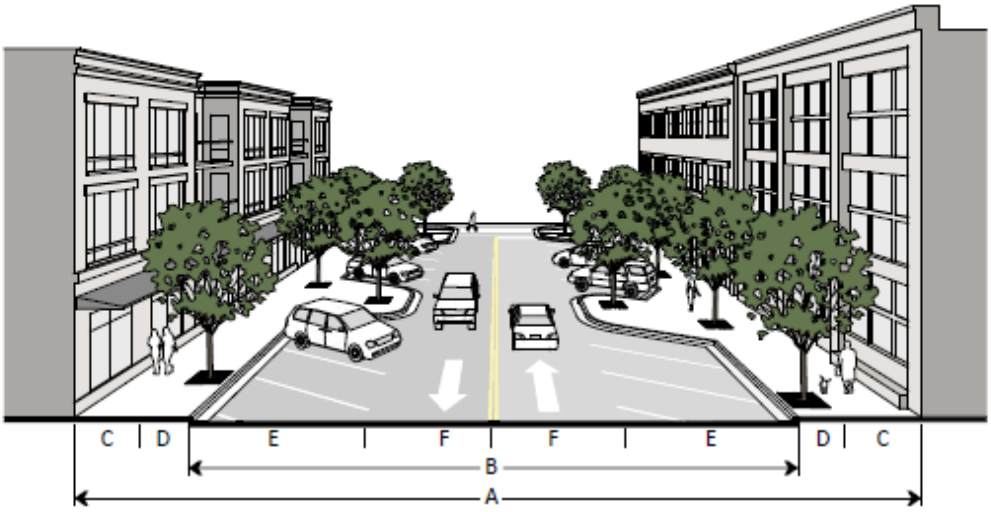
The Main Street typology is most appropriate in where active frontage and mixed commercial uses exist. On-street parking can be installed in parallel or angled fashion, depending on need and available right-of-way. Due to high anticipated pedestrian activity, target vehicular speeds are kept low. This condition also allows bicycles to share space with automobiles in general travel lanes, negating the need for distinct bike lanes.

Main Streets are primary candidates for “festival” treatments, in which a portion of the street may be temporarily restricted to non-motorized traffic only for special events such as a farmer’s market or block party. Additional landscaping and traffic calming techniques that are ideal on Main Streets include street trees in grated wells, curb bulb-outs, and a relatively high density of street furniture and public art. Pedestrian-scale street lighting should be installed, and utilities should be located underground, in alleys or other streets to the greatest extent possible.

4.3.4 Main Street Parallel Parking

Width		
A	Right-of-way width	69'
B	Back-of-curb to back-of-curb	37'
Streetscape		
C	Sidewalk (min)	10'
D	Planting area (min)	6'
Travelway		
E	Parallel parking lane	8.5'
F	Travel lane	12'
General		
Walkway type	Sidewalk	
Planting type	Tree grate	
Tree spacing	40' o.c. avg	
Parking type	Parallel	

4.3.5 Main Street Angular Parking



Width		
A	Right-of-way width	82'
B	Back-of-curb to back-of-curb	60'
Streetscape		
C	Sidewalk (min)	10'
D	Planting area (min)	6'
Travelway		
E	60° angle parking lane	18'
F	Travel lane	12'
General		
Walkway type	Sidewalk	
Planting type	Tree grate	
Tree spacing	40' o.c. avg	
Parking type	60° angle	

Engineering Specifications	
Target Speed (mph)	25 mph
Design Speed (mph)	25 mph
Control Vehicle	WB-40
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	> 100' apart
Median Opening Distance	> 200' apart
Partial Medians/Island	Optional
Curb Radii	10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters, shelters,
Low Impact Development (LID)	Rain Gardens

4.4 Major Streets

There are several categories of street classified as “Major Streets” including Avenues with four or more lanes, Parkways, and Boulevards.

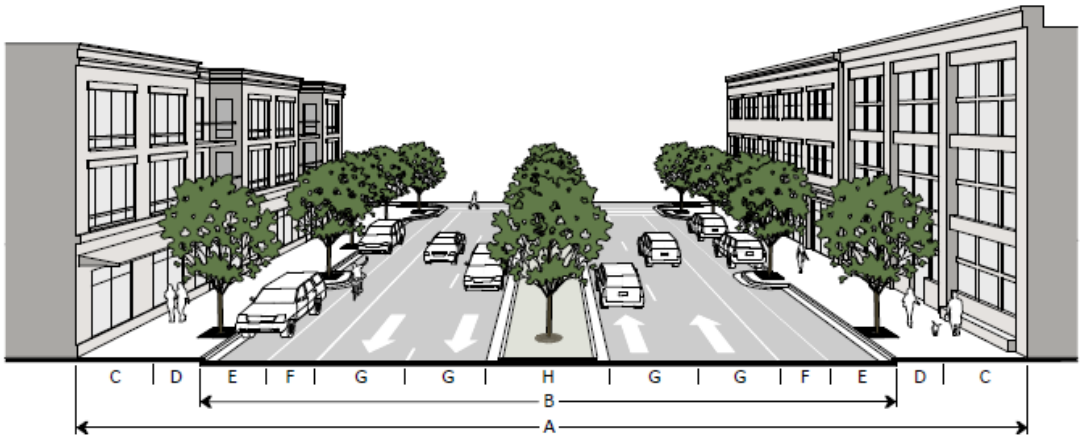
Higher-capacity Avenues have a similar purpose to Avenues with only two through lanes, but may be more appropriate in collector or minor arterial retrofit situations where minimal roadway connectivity is present. Avenues with four or more lanes always feature medians. Signalized intersections are spaced further apart on major streets to better facilitate vehicular mobility. Midblock pedestrian crossings should be frequently installed to maintain walkability in areas where the context dictates that pedestrian usage could be heavy.

Boulevards are designed to support multiple travel modes, including automobiles, freight movers, transit vehicles, pedestrians and bicyclists. Boulevards balance high vehicular capacity with high pedestrian accessibility and moderate vehicular speeds. The most important transit routes are located along these corridors.

There are two typical multi-way boulevard configurations: parallel and angled parking where a center median exists with two additional side medians and accessway. Multi-Way configurations are intended to fully support multiple travel modes, providing a high level of mobility and access. They have high vehicular capacity, side accessways provide additional options for right turns, allowing intersections to operate more efficiently.

4.4.1 Avenue 4-Lane, Parallel Parking

The four lane avenue provides a good level of mobility for all street users, and is a preferred street typology for transit vehicles and cyclists in particular. Medians provide refuge for crossing pedestrians. For more urban contexts, the width of the Streetscape may be expanded.



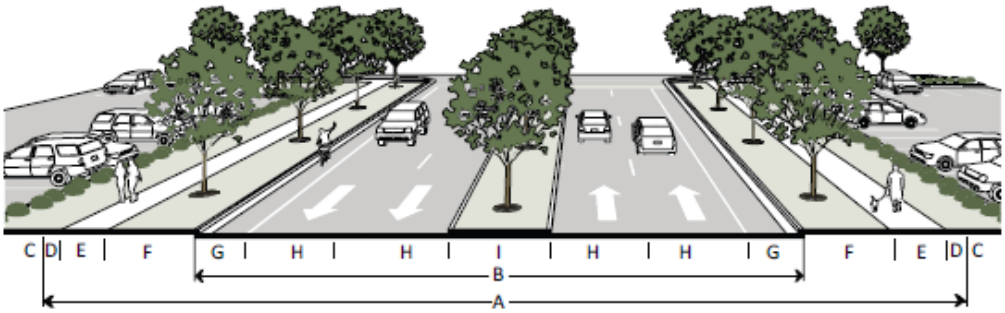
Width		
A	Right-of-way width	120'
B	Back-of-curb to back-of-curb	88'
Streetscape		
C	Sidewalk (min)	10'
D	Planting area (min)	6'
Travelway		
E	Parallel parking lane	8.5'
F	Bike lane	6'
G	Travel lane	11'
H	Median	15'
General		
Walkway type		Sidewalk
Planting type		Tree grate / lawn
Tree spacing		40' o.c. avg
Parking type		Parallel

Engineering Specifications	
Target Speed (mph)	30 mph
Design Speed (mph)	30 mph
Control Vehicle	WB-62
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	200' min.
Median Opening Distance	200' min. (may be increased to accommodate a turn lane providing necessary strorage length and appropriate taper
Partial Medians/Island	No
Curb Radii	15'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bicycle racks, benches, parking meters, shelters,
Low Impact Development (LID)	Rain Gardens

Avenue 4-Lane and 6-Lane Divided

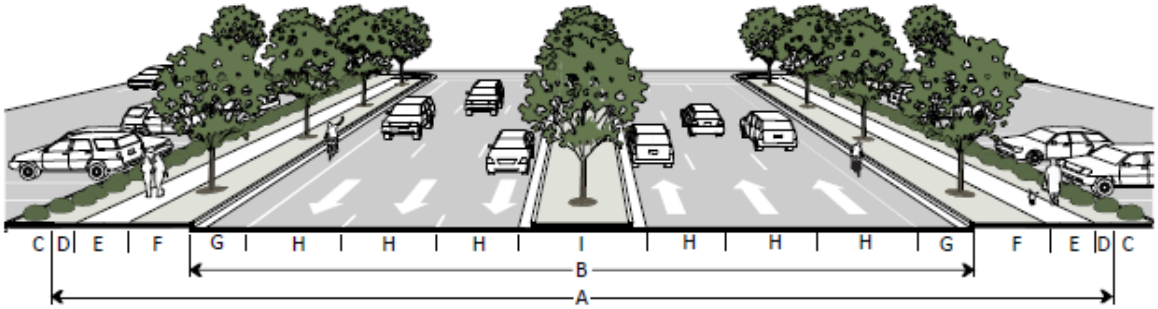
This cross-section features four or six general travel lanes, bike lanes, and buffered sidewalks on both sides of the street. Due to the emphasis on through vehicle mobility, it is not conducive to on-street parking; however, the outside general travel and bike lane could be reconfigured to be a transit / bike / right-turn only lane should it be warranted by context and placed within the multimodal transportation network.

4.4.2 Avenue 4-Lane, Divided



Width		
A	Right-of-way width	101'
B	Back-of-curb to back-of-curb	73'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Bike lane	7'
H	Travel lane	11'
I	Median	15'
General		
Walkway type		Sidewalk
Planting type		Tree grate / lawn
Tree spacing		40' o.c. avg

4.4.3 Avenue 6-Lane, Divided



Width		
A	Right-of-way width	123'
B	Back-of-curb to back-of-curb	95'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'

Travelway		
G	Bike lane	7'
H	Travel lane	11'
I	Median	15'
General		
Walkway type		Sidewalk
Planting type		Tree grate / lawn
Tree spacing		40' o.c. avg

Engineering Specifications	
Target Speed (mph)	35 mph
Design Speed (mph)	45 mph
Control Vehicle	WB-62
Design Vehicle	WB-40
Signalized Intersection Density	As warranted
Driveway Spacing	> 200'
Median Opening Distance	Only at intersections
Partial Medians/Island	No
Curb Radii	20'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Benches, shelters,
Low Impact Development (LID)	Rain Gardens

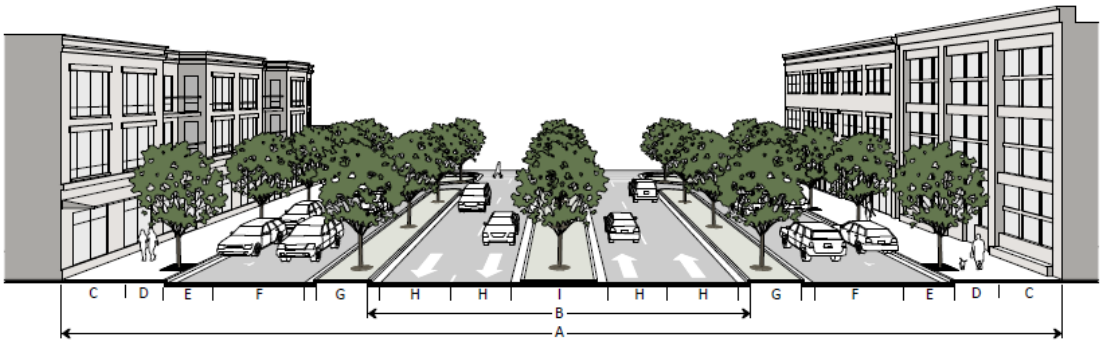
Multi-Way Boulevard (parallel and angular parking)

A Multi-Way Boulevard is used to provide a high level of both access and mobility. These boulevards consist of general travel lanes separated from side accessways with raised center and side medians, which contain landscape features, transit shelters, or other items.

On-street parking is placed within accessways, either in parallel or angled fashion.

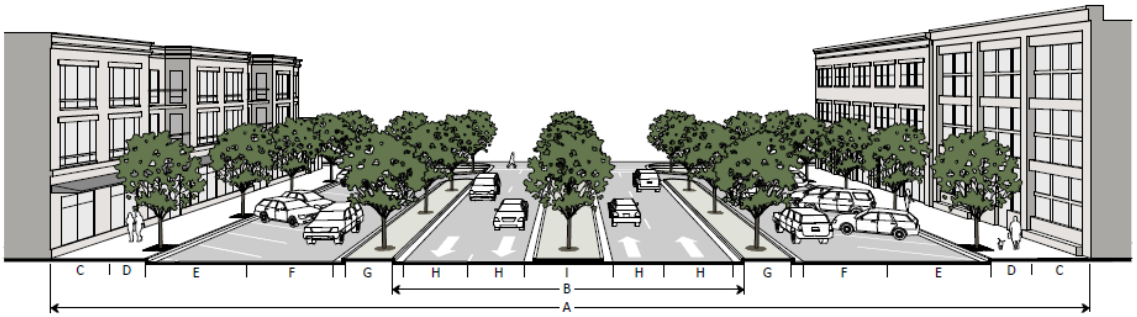
Bicyclists are expected to use accessway lanes rather than general travel lanes for mobility.

4.4.4 Multi-Way Boulevard, Parallel Parking



Width		
A	Right-of-way width	152'
B	Back-of-curb to back-of-curb	64'
Streetscape		
C	Sidewalk (min)	10'
D	Planting area (min)	6'
Access Lane		
E	Parallel parking	8.5'
F	Access lane	11'
G	Median	11'
Travelway		
H	Travel lane	11'
I	Median	15'
General		
Walkway type		Sidewalk
Planting type		Tree grate / lawn
Tree spacing		40' o.c. avg
Parking type		Parallel in access lane

4.4.5 Multi-Way Boulevard, Angular Parking



Width		
A	Right-of-way width	171'
B	Back-of-curb to back-of-curb	64'
Streetscape		
C	Sidewalk (min)	10'
D	Planting area (min)	6'
Access Lane		
E	60° angle parking	18'
F	Access lane	11'
G	Median	11'
Travelway		
H	Travel lane	11'
I	Median	15'
General		
Walkway type		Sidewalk
Planting type		Tree grate / lawn
Tree spacing		40' o.c. avg
Parking type		60°angle in access lane

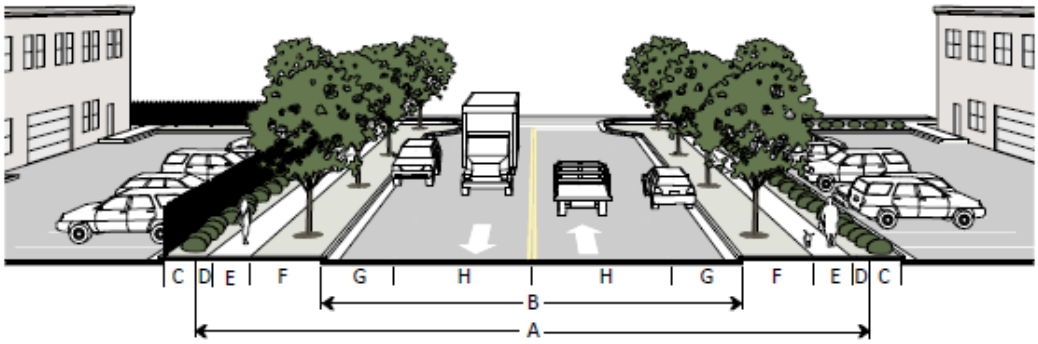
Engineering Specifications	
Target Speed (mph)	35 mph in general lanes, 5-10 mph in accessways
Design Speed (mph)	35 mph in general lanes, 5-10 mph in accessways
Control Vehicle	WB-62
Design Vehicle	WB-40 (General Lanes), SU-30 (Accessways)
Signalized Intersection Density	As warranted
Driveway Spacing	> 200'
Median Opening Distance	Only at intersections
Partial Medians/Island	No
Curb Radii	15'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	Bike racks, Benches, shelters,
Low Impact Development (LID)	Rain Gardens, Median Plantings

4.5 Industrial and Service Streets

Within industrial areas and office parks in particular, it is important to provide separate pedestrian accommodation as well as vehicular lanes

A related typology is the alley, defined as a narrow low-speed road behind buildings that provides access to parking, service areas and rear uses such as accessory structures. It may also accommodate utilities, in shoulders or easements. Some informal pedestrian and bicycle use is to be expected on alleys, but these activities can share space with motorized vehicles due to land constraints, general lack of amenities, and low traffic volume.

4.5.1 Industrial Street

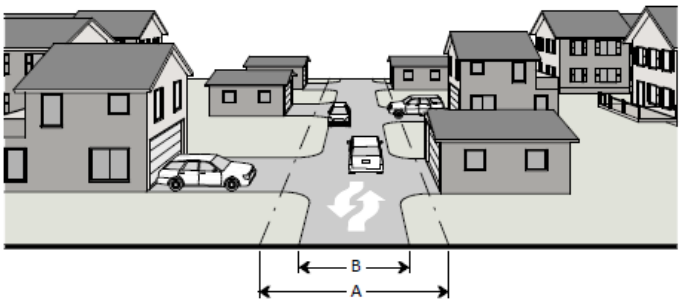


Width		
A	Right-of-way width	69'
B	Back-of-curb to back-of-curb	41'
Streetscape		
C	Utility placement, easement (min)	5'
D	Maintenance strip (min)	2'
E	Sidewalk (min)	6'
F	Planting area (min)	6'
Travelway		
G	Parallel parking lane	8.5'
H	Travel lane	12'
General		
Walkway type		Sidewalk
Planting type		Tree lawn
Tree spacing		40' o.c. avg
Parking type		Parallel

Engineering Specifications	
Target Speed (mph)	20 mph
Design Speed (mph)	20 mph
Control Vehicle	WB-62
Design Vehicle	WB-62
Signalized Intersection Density	As warranted
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	25' +
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Permeable Pavement

4.5.2 Alley, Residential (Private)

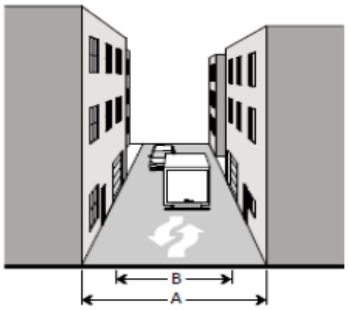
Residential alleys can provide access to accessory housing units and rear-entry parking, as well as provide a location for utilities and services such as garbage removal if built to street standards to support those types of vehicles. They vary in total width from 16’ to 20’. Alleys can also provide shortcuts for pedestrians and cyclists. They are ideal locations to implement low impact development techniques such as permeable pavement.



Width		
A	Easement width	20'
Travelway		
B	Travel lane	16'
B	Travel lane, fire service route	20'

4.5.3 Alley, Mixed Use (Private)

Mixed Use Alleys provide access to service entrances, loading docks, and garages as well as providing a location for utilities and garbage. They vary in width from 20 to 24 feet, depending on whether they are one-way or two-way. They are ideal locations to implement low impact development techniques such as permeable pavement.



Width		
A	Easement width	24'
Travelway		
B	Travel lane	20'

4.6 Accessways

Accessways are used to provide a formal travel path within a block for pedestrians and/or vehicles.

4.6.1 Primary Internal Access Drive

The primary internal access drive typology can be applied to the main entrances of major developments set back from roads such as malls, corporate offices, and high volume strip centers. It provides pedestrian and vehicular access as well as design flexibility for future retrofits (such as infill development adjacent to this street). Sidewalks shall be provided on both sides of the street. This typology is typically applied to a private easement within a property, though may be converted to future public use as part of a grid-reliant infill and redevelopment opportunity.

Width		
A	Back-of-curb to back-of-curb	36'
Streetscape		
B	Planting strip (min)	5'
C	Sidewalk (min)	6'
Travelway		
D	Parallel parking lane	8'
E	Travel lane	10'
General		
Walkway type	Sidewalk	
Parking type	Parallel	

Engineering Specifications	
Target Speed (mph)	15 mph
Design Speed (mph)	15 mph
Control Vehicle	WB-62
Design Vehicle	SU-30
Signalized Intersection Density	N/A
Driveway Spacing	As needed
Median Opening Distance	N/A
Partial Medians/Island	No
Curb Radii	5-10'
Lighting	Required on all public streets for new development, pedestrian scale optional and responsibility of developer
Furniture	As needed
Low Impact Development (LID)	Permeable Pavement, Rain Gardens

4.6.2 Pedestrian Passage

Pedestrian passageways are off-limits to motorized vehicles and provide additional pedestrian and bicycle connectivity through medium and large blocks. They may be used in any context. The typology may also be applied to standalone greenways and shall be constructed of a durable material to facilitate pedestrian movements and are dedicated as public access easements.

Width		
A	Public access easement (min)	20'
Travelway		
B	Paved or approved hard surface (min)	10'
General		
Walkway type	Sidewalk	

Engineering Specifications	
Target Speed (mph)	5 mph
Design Speed (mph)	5 mph
Control Vehicle	Bicycle
Design Vehicle	Person
Lighting	Optional, Pedestrian Scale, light/motion sensitive
Furniture	As needed
Low Impact Development (LID)	Permeable Pavement, Rain Gardens

Section 5 – Administrative Procedures and Policies

Many of these policies and procedures can be found in the Unified Development Ordinance (hereby UDO), the City of Raleigh Code.

5.1 Administrative Design Adjustment

Administrative Design Adjustment Findings may be found in Chapter 8 of the UDO. They may be applied to regulations in Article 8.3 for Blocks, Lots, Access, and Article 8.4 for New Streets and Article 8.5 for Existing Streets.

<u>Blocks, Lots, Access</u>
The Public Works Director may in accordance with Sec. 10.2.18 approve a design adjustment, subject to all of the following findings:

A. The approved design adjustment meets the intent of this Article.

B. The approved design adjustment complies with the Comprehensive Plan and adopted City plans.

C. The approved design adjustment does not increase congestion or compromise safety.

D. The approved adjustment does not create any lots without direct street frontage.

E. The design adjustment is deemed reasonable due to one or more of the following:
1. Topographic changes are too steep;
2. The presence of existing buildings, streams, other natural features;
3. Site layout of developed properties;
4. Adjoining uses or their vehicles are incompatible; or
5. Strict compliance would pose a safety hazard.
6. Does not conflict with an approved or built roadway construction project adjacent to or in the vicinity of the site.

F. No design adjustment shall be approved when the City Council has authorized a roadway project in the vicinity, where the roadway design has not yet been finalized.

New Streets

The Public Works Director may in accordance with Sec. 10.2.18 approve a design adjustment, subject to all of the following findings:

Administrative Design Adjustment Findings

The Public Works Director may in accordance with Sec. 10.2.18 approve a street design adjustment, subject to all of the following findings:

1. The approved adjustment meets the intent of this Article.
2. The approved adjustment complies with the Comprehensive Plan and adopted City plans.
3. The approved adjustment does not increase congestion or compromise safety.
4. The approved adjustment does not create additional maintenance responsibilities for the City.
5. The approved adjustment has been designed and certified by a Professional engineer.
6. The approved adjustment shall address stormwater collection and conveyance and not adversely impact stormwater collection.

Existing Streets

The Public Works Director may in accordance with Sec. 10.2.18 approve a design adjustment, subject to all of the following findings:

Administrative Design Adjustment Findings

1. The approved adjustment meets the intent of this Article.
2. The approved adjustment complies with the Comprehensive Plan and adopted City plans.
3. The approved adjustment does not increase congestion or compromise safety.
4. The approved adjustment does not create additional maintenance responsibilities for the City.
5. The approved adjustment has been designed and certified by a Professional engineer.

5.2 Encroachments in the Public Right of Way (Major and Minor)

The Encroachment approval is a process, which allows private property owners; firms or corporations request use of the Public Right of Way for private purposes, such as landscaping, structures or outdoor dining. This review process is intended to ensure the health and safety of the public, as well as protection against potential damage to the streetscape, trees and vegetation, sidewalks, streets, and other publicly owned amenities.

5.2.1 Major Encroachments

The Major Encroachments process allows for a review and approval of private uses of public property in most parts of the City, such as subdivision signs in the right-of-way, cable or data transmission lines, private landscaping in the public right-of-way, signs overhanging the public right-of-way, awnings extending over property lines, etc. These requests must be reviewed and approved by the City Council after a staff review process

5.2.2 Minor Encroachments

Private uses of public property in any of these areas: Downtown Mixed Use District, Glenwood South Business Districts, North Person Street Business District and Peace Street Business District. Standards for this type of encroachment are outlined in the Comprehensive Plan.

5.3 Infrastructure Requirements

5.3.1 Infrastructure Sufficiency

A. To lessen congestion in the streets, and to facilitate the efficient and adequate provision of transportation, water and sewage and to secure safety from fire, every subdivision plan and site

plan shall be subject to a determination of the sufficiency of infrastructure, as defined below according to the established levels of service in this Article.

B. Infrastructure shall be considered sufficient where it is demonstrated to have available capacity to accommodate the demand generated by the proposed development as well as other approved developments and Planned Development Master Plans.
C. In order to avoid undue hardship, the applicant may propose to construct or secure sufficient funding for the facilities necessary to provide capacity to accommodate the proposed development at the adopted level of service. The commitment for construction or advancement of necessary facilities shall be included as a condition of development.

5. 3.2 Roadway Construction Through and Adjoining Developments

All public roadways inside the Corporate limits of the City shall be constructed in conformance with *City standards and specifications*; however, if the roadway is maintained by NCDOT, then the roadway shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

All public roadways that are outside the Corporate limits of the City and when water or sewer is connected to the City utility system or made available within one (1) year after approval of a development plan, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

Roadways that are outside the Corporate limits of the City and where neither City water nor sewer are available or made available within one (1) year after approval of a site plan, shall be constructed in conformance with NCDOT standards and specifications.

Roadways that are within a Reservoir Watershed Protection Area Overlay District or classified as a sensitive area thoroughfare, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

The minimum design cross-section for roadways constructed to City standards are illustrated in Section 3. Consult NCDOT for minimum design cross-sections for roadways that require their approval.

5.3.3 Minimum Paving Construction

The developer shall be responsible for the cost and installation of the applicable standard non-thoroughfare street width and pavement design requirements. Frontage improvements shall be installed for roadways through and adjoining the development in accordance with adopted City or State standards and specifications. The developer shall make street improvements in accordance with this section. The developer shall also provide additional pavement surfaces for turning movements to serve the development where prescribed by a traffic impact analysis or as specified elsewhere in this chapter. Street improvements required in excess of minimum paving construction standards associated with a site plan may be eligible for reimbursements per Section 8.6.3 of the UDO. Additional pavement

surfaces required to accommodate turning movements generated by the development are not eligible for reimbursement.

The City may elect to require payment of a fee-in-lieu of installation to the applicable minimum paving construction standards as outlined in this section. Methodology for requiring fee-in-lieu payments is specified in the City's administrative regulation for "Fee-in-lieu of Determination and

An exemption from paving construction requirements shall not relieve the developer of a payment in-lieu of construction unless otherwise specified below.

5.3.4 Fee in Lieu

Where the Public Works Director determines that construction of public improvements would not be feasible, a fee in lieu may be permitted. In this instance, right-of-way dedication and all necessary easements shall be dedicated to the city. Engineering drawings may be required to determine the extent of public improvements and easements.

The installation of the designated streetscape is part of the construction of public improvements and shall be subject to a fee in lieu when the street is not to be constructed. In the event the streetscape is not installed, the following fee shall apply based on each tree required or tree grate that is installed. There are two types of street tree installation fees:

1. Tree lawn: See Fee schedule for the fee. $1650

2. Tree Grate: See Fee schedule for the fee $5533

5.3.5 Exceptions To Paving Construction

Streets with curb and gutter, other than thoroughfare or collector system roadways, which were built pursuant to earlier City or State paving standards, do not have to be widened unless such widening is needed to alleviate safety problems or increased traffic congestion. But sidewalks construction, curb and gutter improvements, and right-of-way dedications required in this chapter shall not be exempted by this provision.

Developments will not be responsible for street and streetscape construction requirements along existing or planned roadways if any of the following conditions exist:

1) Exemptions for construction shall be provided for existing single-family lots, single-family subdivisions which have all lots fronting on existing streets, and multi-unit conversions of existing single-family homes, except when construction is needed to extend adjacent street and sidewalk facilities.

2) Exemptions for street construction and fee-in-lieu payment for curb and gutter and sidewalk shall be provided for frontage on roadways that are exempt from curb and gutter requirements, such as streets within a Watershed Protection Overlay District. Construction or fee-in-lieu payment for additional pavement widths to provide sufficient travel lane or shoulder widths per minimum City or State standards may still be required.

3) Exemptions for street construction shall be provided for frontage along future thoroughfares when construction as part of the development is not required in the plan approval process.

4) Exemptions for street construction and fee-in-lieu payment shall be provided for frontage along streets approved for construction funding by the State Transportation Improvement Program or other State funding programs, provided that the NCDOT Board of Transportation has authorized the project for public bid or for right-of-way acquisition. The City's street improvement assessment policies may be applicable in these cases, as directed by the City Council.

5) Exemptions shall be provided for frontage along streets approved for construction funding in the City's Capital Improvement Program, provided that the City Council has authorized the project for public bid or for right-of-way acquisition. The City's normal street improvement assessment policies will be applicable in these cases, as directed by the City Council.

6) Exemptions for street construction and fee-in-lieu payment shall be provided for frontage along existing or planned future roadways having full control of access (i.e., no direct access from the property to the roadway is permitted;

7) Exemptions for construction shall be provided where the City for the same improvements, or on a property where assessments for same street improvements by the City were previously levied has received a previous fee-in-lieu payment. In certain cases, the City may elect to refund a previous fee-in-lieu payment if the Public Works Director determines that construction of frontage improvements would be more appropriate.

5.4 Infrastructure Construction Drawings

Construction Drawings are required to perform public and/or private infrastructure improvements such as (roadway, stormwater, water, sewer or streetscape. Plan reviewers from Stormwater, Public Utilities, Street Maintenance, Fire, Urban Forestry, Planning and Parks and Recreation review Infrastructure Construction Drawings for compliance with all applicable Raleigh City Code requirements. Upon final approval of Infrastructure Construction Drawing (blue lines) the client will submit mylars for sign off by the City of Raleigh plan review staff. Mylar sign off results in the permit issuance for water, sewer and roadway work in the public right-of-way.

Prior to being placed into service, all sewer main extensions and water/sewer service connections to the City's water and sanitary sewer systems installed by a private contractor shall be inspected and

determined to have been properly installed by inspectors from the City's Public Works Department and the City's Public Utilities Department.

5.5. Infrastructure Reimbursements

5.5.1 Improvements Eligible for Reimbursement

1. The City will pay to the developer unit costs for development-related improvements over and above the unit costs for applicable streets.
2. The following installations are eligible for reimbursement:
    a. Any street construction in excess of the minimum standard needed to serve the development additional improvements to the rights of way.
    b. Any right-of-way dedication in excess of the minimum standard needed to serve the development.
    c. Right-of-way for controlled-access freeways.
3. Reimbursements are subject to availability of funds and eligibility for reimbursement through the City's facility fee program.

5.5.2 Expiration of Reimbursement

Section 8.6.4 (new section)
Expiration of Reimbursement
Any request for reimbursement for street, greenway or utility installation must be submitted to the City within two years of completion and acceptance by the city or state, whichever is applicable.

5.6 Construction Surety

A. If all development-related improvements and installations are not completed and accepted by the City prior to a request to record all or a part of any subdivision or issuance of a building permit for any site plan, whichever first occurs, a security instrument shall be posted, in lieu of completion of the work, in an amount of 125% of the estimated construction cost of the development-related improvements which remain incomplete and with surety and conditions satisfactory to the City, providing for and securing to the City the actual construction and installation of improvements.

B. All development-related improvements that are secured by a surety shall be installed prior to the issuance of the first certificate of occupancy within the subdivision phase or prior to the issuance of the first certificate of occupancy for the site plan, whichever event first occurs on the property; however, the final coat of asphalt for street improvements and the installation of required street furniture or sidewalks may at the option of the applicant be installed within 24 months following the issuance of the first certificate of occupancy provided surety in the amount of 125% of these improvements are first provided to the City. Where improvements are required on a State-maintained road, a 100%

construction surety is required. In this instance, proof of bond or surety with the State must be supplied to the City.

C. Where the Director of Public Works determines that landscaping in the public right-of-way cannot be installed due to inclement weather conditions, a surety in the amount of 125% of the value of the landscaping shall be provided to the City, in accordance with section 8.5.1.B. The landscaping improvements shall be installed within 12 months of issuance of the conditional letter of final acceptance.

5.7 Mass Grading

When an applicant wishes to clear land and perform grading activities on a site and when **no improvements** to the site are proposed they submit plans under the Mass Grading process. The plans will be reviewed by Plan Reviewers from Stormwater, Tree Conservation, Fire Protection, and Transportation Services for compliance with all applicable Raleigh City Code requirements.

A Land Disturbance Permit must be obtained when an applicant wishes to disturb >12,000 square feet of land per City Code Part 10A., Chapter 9 of the UDO.

5.8 NCDOT Coordination

Any time a project has the potential to impact a State maintained roadway coordination with the North Carolina Department of Transportation (NCDOT) is necessary. Within the City of Raleigh's jurisdiction, the City has site plan approval for developments; however on State maintained roadways the NCDOT has the ultimate authority for any work in the Right of Way. It is the sole responsibility of the requesting party to determine if a street is State maintained or not.

It is common for a project to involve both the NCDOT and the City of Raleigh. Plan submittals, review and approvals shall be coordinated concurrently with both agencies to avoid conflicting requirements. In situations where an agency's regulation differs from that of the other agency, the more restrictive of the two shall govern. A joint meeting between the applicant, NCDOT and the City is recommended early in the process to discuss project details, such as, location and type of access, potential roadway improvements, necessary Right of Way dedication and a project timeline.

Because NCDOT's review process does not always coincide with the City's, the applicant is encouraged to coordinate early and often with the two agencies. Notification of any changes to a project's plan based on review comments or requirements is essential to avoiding delays in the approval process.

The NCDOT's Street and Driveway Access Permit Application requires a Local Governmental Authority's approval prior to submission. The City must have an approved Site Plan prior to signing NCDOT's

application form. Likewise, the City will withhold final Infrastructure construction drawing approval until all executed NCDOT permits are approved.

As a project moves forward into the construction phase, both the NCDOT and the City of Raleigh have enforcement authority to ensure safety in the Right of Way is not compromised. Both agencies have the ability to affect a project's progress if there is reason to believe proper construction practices are not being adhered to and/or if unsuitable materials are being used in the Right of Way. Failure to comply with permits and the approved plans may result in revocation of permits and project delay.

The City of Raleigh has the authority to withhold the issuance of a Certificate of Occupancy until all work is completed and in compliance with the approved permits.

For additional information regarding the coordination between NCDOT and the City of Raleigh please see *NCDOT-Policy On Street And Driveway Access to North Carolina Highways*, Chapter 2, section A.

5.9 Public Street Right-of-Way Conveyance

Whenever a tract of land included within any proposed development plan embraces any part of a thoroughfare system or collector street system roadway and so designated in the Comprehensive Plan or the Capital Area Thoroughfare Plan, after such part of it has been adopted by the proper authority, such part of such proposed public way shall be platted and dedicated in the location and width indicated on the plans. However, no development shall be required to plat more than one hundred ten (110) feet of *right-of-way*, plus *slope easements* as needed except in any of the following instances:

1) Freeways/expressways - the minimum right-of-way width required to serve a development. (To determine the minimum required right-of-way for streets by type and intensity, see definitions of roadways in the streets section).

2) Major Streets or gateway arterials which contain a median as shown on the Comprehensive Plan and which appear on the City Capital Improvement Program (CIP) or the Transportation Improvement Program (TIP) of the North Carolina Department of Transportation (*NCDOT*) - the minimum right-of-way width specified on design plans which have been approved by the City Council, but no greater than one hundred thirty (130) feet, plus slope easements as needed.

3) Right-of-way width required for additional pavement surfaces to accommodate turning movements.

In accordance with provisions outlined in the City Code, right-of-way dedications may be eligible for monetary reimbursement.

Developments which embrace only one side of an existing or planned roadway right-of-way will only be required to plat and dedicate additional right-of-way for that portion of roadway with which the development has frontage. Such improvements shall be in conformance with City standards and shall be measured from the *right-of-way center line*.

5.9.1 Right-of-Way Widths

All public roadways, exclusive of slope easements, shall be platted and dedicated in conformance with the schedule of public street right-of-way widths shown in the Schedule of Street Right-of-way widths below.

Schedule of Street Right-of-way widths

Street Classifications	Minimum Right-of-way width (feet)	Public or Private
Sensitive Area Streets		
1. Sensitive Area Parkway	154	Public
2. Sensitive Area Avenue	80	Public
3. Sensitive Area Residential Street	70	Public
Local Street		
1. Neighborhood Yield	55	Public
2. Neighborhood Local	59	Public
3. Neighborhood Street (Collector)	64	Public
4. Multifamily Street	22	Public
Mixed Use Streets		
1. Avenue 2-Lane Undivided	64	Public
2. Avenue 2-Lane Divided	75 with center turn, 79 with median	Public
3. Avenue 3-Lane Parallel Parking	90 with center turn, 94 with median	Public
4. Main Street Parallel Parking	73	Public
5. Main Street Angular Parking	96	Public
Major Streets		
1. Avenue 4-Lane, Parallel Parking	122	Public
2. Avenue 4-Lane, Divided	104	Public
3. Avenue 6-Lane Divided	126	Public
4. Multi-Way Boulevard, Parallel Parking	154	Public
5. Multi-Way Boulevard, Angular Parking	177	Public

Industrial and Service Streets		
1. Industrial Street	69	Public
2. Alley, Residential	20' Easement	Private Accessway
3. Alley, Mixed Use	24' Easement	Private Accessway
Accessways		
1. Primary Internal Access Drive	36' Private (BoC - BoC)	Private with Public Access easement
2. Pedestrian passage	20'	Private with Public Access easement

5.9.2Coordination with Adopted Roadway Plans

It is the responsibility of the developer to take future roadway plans of the City and NCDOT into account when laying out a development plan.

5.9.3 Reservation Periods for Right-of-Way

For thoroughfare system roadways where the planned right-of-way width is greater than that which can be required, (as specified in the preceding paragraphs), the developer shall be required to reserve the extra right-of-way width for a period not to exceed twelve (12) months from the date of approval of the development plan.

5.9.4 Slope Easements

A slope easement of twenty (20) feet in width shall be required adjoining each side of a street right-of-way. The City may reduce or increase the slope easement width if due to terrain.

If a property owner submits to the City sufficient information to show that improvements to be located in the slope easement do not interfere with the right of the public to construct within the adjoining right-of-way; streets, sidewalks, or both, then the City shall allow the proposed improvement.

5.9.5 Adjustments to Required Right-of-Way Widths

The Public Works Director may reduce the required minimum right-of-way width due to the location of an existing building or use in the proposed new right-of-way, upon finding that the reduced right-of-way shall be able to accommodate the planned future cross section.

5.10 Temporary Right of Way Closure for Public Streets and Sidewalk

All sidewalk, traffic lane and on street parking closures must allow for safe vehicular traffic flow and pedestrian access around the construction site. Sidewalk closures result in re-routing pedestrian traffic and must be reviewed for the safe movement of pedestrians and meet ADA (American Disability Act) requirements during construction.

Travel lanes and parking lanes must be regulated per MUTCD standards

Extra planning and design must be considered to provide for safe movement of vehicular and pedestrian traffic. In areas where pedestrian activity is a priority such as where the DX district is mapped or where SF, UG or UL frontages are mapped.

Right of Way plan elements for temporary street/sidewalk closures associated with Commercial projects must include the following at a minimum:

- location of the building on the site location of the sidewalk
- location of on-street parking
- direction of travel lanes
- description of same improvements 100 feet to either side of the site
- location of eight (8) foot chain link fence
- location of covered sidewalk and details of construction in accordance with the NC State Building Code, Chapter 33
- site accessibility/ADA requirements in accordance with the NC Building Code and Section 8.3.5 of the UDO
- location of barricades
- location of traffic merge cones
- location of businesses affected by barricades and/or fences
- estimated timeframe for project

5.11 Right-of-Way Permits

For all permit issuance and fees, please see the Development Services – Customer Service Center or the current Development Fee Schedule.

5.11.1 Site Final

The inspector will check the condition of the Roads, and site related items.

5.11.2 Construction Purposes

When work occurs in the public right of way such as lane closures, sidewalk closures and items not dealing with streets or sidewalk, this permit will be applied.

5.11.3 Driveway/Sidewalk

When new curb cut construction is proposed, this permit will be applied.

When new sidewalk construction is proposed, not related to Infrastructure Construction Drawings, this permit will be required.

5.11.4 Street Cut permits (Permit to do work in the Public Right of Way)

When existing sidewalk or a driveway is modified or replaced, this permit will be applied.

When utility contractors are doing work in the public right of way, this permit will be applied.

5.11.5 Lane Closure Permit

A permit required for the closure of a travel lane and parking lane measured from Back of Curb to Back of Curb.

5.12 Site Plan Review

When an applicant wishes to clear land, perform grading activities, *and install improvements on a site*, plans for Site Review must be submitted in accordance with Section 10.2.8 of the UDO. . Improvements and review include but are not limited to stormwater pipes or detention devices, utility lines, building locations, street improvements, driveways, parking lots, retaining walls, landscaping, zoning, tree conservation and site accessibility. The plans will be reviewed for compliance with all applicable Raleigh City Code requirements. Zoning, tree conservation, grading and other applicable permits shall be applied to the permit application.

Section 6 Planning and Design Criteria

6.1 Accesses and Connectivity

Connectivity standards determine the size and layout of blocks within a place and the general density of intersections of transportation facilities, whereas access standards determine the location of points of entry and egress within blocks.

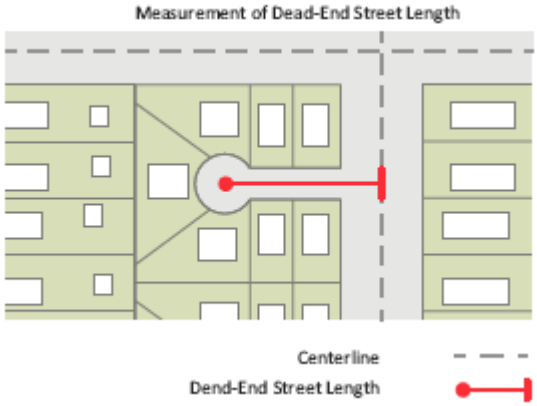
6.1.1 Connectivity Standards

The existence of intersections and availability of transportation network connections is a primary determinant of walkability. As such, dead-end streets should be avoided. Exemptions from connections are found in Chapter 8 of the UDO.

This table summarizes block perimeter and dead end street regulation by zoning district. This table is also located in Chapter 8 of the *Raleigh Unified Development Ordinance*.

Block Perimeter and Dead End Streets		
	Block Perimeter (max.)	**Dead End Street (max.)**
R-1, R-2, R-4, R-6: Average Lot Size on Block		
40,000+ sf	8,000'	1,000'
20,000 - 39,999 sf	6,000'	750'
10,000 - 19,999 sf	5,000'	600'
6,000 - 9,999 sf	4,500'	550'
up to 5,999 sf	3,000'	400'
R-10: By District		
R-10	2,500'	300'
Mixed Use Districts		
DX-, -TOD	2,000'	Not allowed
RX-, NX-, CX-, OX-: 3 or 4 Stories	3,000'	400'
RX-, NX-, CX-, OX-: 5 Stories	2,500'	300'
OP-, IX-,	4,000'	500'
Special Districts		
CM, AP	n/a	n/a
IH	6,000'	400'
MH	3,000'	400'
CMP, PD	4,000' or based on master plan	400' or based on master plan

Graphic 2



6.2 Access Standards

6.2.1 General Access Requirements

1. All existing and proposed development must provide a satisfactory means of vehicular, pedestrian and bicycle ingress and egress to and from a street or an abutting site.

2. All on-site parking areas must have vehicular access from a street, an alley, a drive aisle or a cross-access easement.

3. All on-site parking areas must be designed to allow vehicles to enter and exit the parking area in a forward motion, unless otherwise approved by the Public Works Director. An improved alley may be used as maneuvering space for access to on-site parking areas.

4. All lots within any Mixed Use District and all lots abutting street rights of way greater than 100 feet in width must provide cross access with abutting properties unless otherwise not required by the Public Works Director in accordance with Sec. 8.3.6.

5. Subdivisions must provide roadways that remain permanently open to the public and provide community-wide access as part of an overall connected street network

6.3 Pedestrian Access

1. All existing and proposed development must provide safe, direct and convenient pedestrian access connecting main entrances of buildings, establishments or uses on a site that allows for public access, with all other such entrances and with available access points including parking, streets, sidewalks and transit stops with the exception of the following uses which are exempt:

a. Single- or two-unit living.

b. Multi-unit living with six or fewer dwelling units.
c. Agricultural use.
d. Parks, open space and greenways.
e. Cemetery.
f. Telecommunication tower.
g. Off-premise sign.
h. Minor utilities.
i. Other uses not containing a principal building on the premise (with the exception of a parking facility).

2. Pedestrian access shall consist of an accessible, easily discernible, and ADA-compliant walkway or multi-use path with a minimum width of five feet.

3. The pedestrian access surface located on private property shall be constructed of concrete, asphalt or other fixed, firm and nonslip material as approved by the Public Works Director.

4. Pedestrian access routes between buildings and public rights-of-way shall be physically separated from vehicular surface areas, except where required to cross a drive aisle; such crossings shall be perpendicular wherever practicable.

5. Site plans containing multiple principal buildings shall submit a phasing plan. The phasing plan shall include all necessary elements to address phasing of walkway construction for the existing principal buildings and uses on the site as new buildings and building expansion occur in the future.

6.4 Sidewalk

6.4.1 Location and Coverage of Sidewalks

All public roadways inside the Corporate limits of the City and outside the City when water or sewer is connected to the City utility system, shall be constructed with sidewalks installed on both sides of any new street.

The sidewalk location may be altered from the standards shown in Chapter 8 if an obstruction exists and the modified location will not pose any safety problems. Additional right-of-way or easements may be required if sidewalk is located outside the existing right-of-way.

Sidewalks shall be required in areas served by any street. Sidewalks shall provide general pedestrian access within the development served and shall connect with public sidewalks, public streets, and greenway access points. Each block, or each building in the case of multi-unit living, shall be served by a connection to the pedestrian access system.

Except for alleyways, in no case is it allowable to construct a transportation facility of any typology expressed in this handbook without distinct and accessible pedestrian accommodations.

All public roadways inside the corporate limits of the City and outside the City when water or sewer is connected to the City utility system shall be constructed with sidewalk. See Table 3 for sidewalk location requirements on City standard streets.

Sidewalk Location Requirements

Street Classifications	Both Sides	Type	Min. width
Sensitive Area Streets			
1. Sensitive Area Parkway	X	Multi-use path	10'
2. Sensitive Area Avenue	X	Sidewalk	5'
3. Sensitive Area Residential Street	X	Sidewalk	5'
Local Street			
1. Neighborhood Yield	X	Sidewalk	6'
2. Neighborhood Local	X	Sidewalk	6'
3. Neighborhood Street (Collector)	X	Sidewalk	6'
4. Multifamily Street	X	Sidewalk (easement)	6'
Mixed Use Streets			
1. Avenue 2-Lane Undivided	X	Sidewalk	6'
2. Avenue 2-Lane Divided	X	Sidewalk	6'
3. Avenue 3-Lane Parallel Parking	X	Sidewalk	8'
4. Main Street Parallel Parking	X	Sidewalk	10'
5. Main Street Angular Parking	X	Sidewalk	10'
Major Streets			
1. Avenue 4-Lane, Parallel Parking	X	Sidewalk	10'
2. Avenue 4-Lane, Divided	X	Sidewalk	6'
3. Avenue 6-Lane Divided	X	Sidewalk	6'

4. Multi-Way Boulevard, Parallel Parking	X	Sidewalk	10'
5. Multi-Way Boulevard, Angular Parking	X	Sidewalk	10'
Industrial and Service Streets			
1. Industrial Street	X	Sidewalk	6'
2. Alley, Residential		Travel Lane	20' Easement width
3. Alley, Mixed Use		Travel Lane	24' easement width
Accessways			
1. Primary Internal Access Drive	X	6'	Sidewalk
2. Pedestrian passage	x	Sidewalk	20' Public Access Easement

The sidewalk location may be altered from the standards shown in Section 4.1 if an obstruction exists and the modified location will not pose any safety problems. Additional right-of-way or easements may be required if sidewalk is located outside the existing right-of-way. Sidewalks shall be provided along the block face of a commercial street that adjoins any shopping center or shopping area, school, stadium or coliseum or arena of over two hundred fifty (250) seats.

Sidewalks meeting the standards of Chapter 8 of the UDO or as approved by Public Works Director. Sidewalks shall provide general pedestrian access within the development served and shall connect with public sidewalks, public streets, and greenway access points. Each block, or each building in the case of multi-unit living, shall be served by a connection to the pedestrian access system.

6.4.2 Sidewalk Access Ramps

Sidewalk access ramps, also commonly referred to as wheelchair ramps for the physically handicapped, shall be provided at all intersections where curb and gutter are provided and where sidewalks and/or greenway trails intersect any street.

6.4.3 ADA Requirements

Accessible routes within the site shall be provided from public transportation stops, accessible parking, accessible passenger loading zones, and public streets or sidewalks to the accessible building entrance served.

All accessible routes shall comply with section Pedestrian access and the NC Building Code.

6.5 Driveway Access

6.5.1 Driveway Dimensions

Driveway dimensions shall be in accordance with the following table:

Width (min)	Width (max)	Radius (max)	
Residential up to 6 spaces	10'	18'	10'
Residential 7+ spaces (one way)	12'	16'	10'
Residential 7+ spaces (two-way)	20'	24'	10'
Mixed Use/Commercial (one-way)	12'	18'	10'
Mixed Use/Commercial (two-way)	20'	32'	15'
Industrial/Service	30'	40'	30'

a. When an improved alley with a width of at least 20 feet in width is provided, all vehicular access shall take place from the alley. Access may be taken from the side street on corner lots.

b. Except for townhouse lots, all lots 40 feet or less in width platted after the effective date of this UDO, are required to take vehicular access from an alley.

c. No residential lot may have more than two driveways on the same street. Multiple driveways that serve one lot may be no closer than 45 feet.

d. Non-alley loaded driveways may intersect a street no closer than 20 feet from the intersection of two street rights-of-way.

e. Driveways must be located a minimum of 3 feet from the side lot line. However, a driveway may be located on the lot line closer than 3’ if permitted per this manual.

f. Parking and driveway areas shall not constitute more than 40% of the area between the front building line and the front property line.

6.5.2 Residential Driveway Access

Residential driveway *access* to and from streets shall be constructed in accordance with City standards as outlined below. For multi-unit living developments one access point from a public street is required for every 150’ dwelling units.

6.5.3 Driveway Type

The standard residential driveway access for the City shall be the “ramp” type driveway section. Ramp type driveways shall be constructed in accordance with City standards and specifications as outlined in the City Code. Driveway and parking dimensions for ramp type driveways for single-family dwellings.

6.5.4 Number of Driveway Access Points

The number of residential driveway access points servicing any lawful lot should be limited to one (1); however, in no instance shall there be more than two (2) residential driveway access points servicing the lot. Residential driveway access points shall also conform to the guidelines for driveway access points along thoroughfare system roadways as presented in Section 4.

6.5.5 Location of Driveway Access Points

Other than residential townhouse, residential driveways shall be spaced at least twenty (20) feet from any other driveway on the same lot and no closer than nearer than three and one-half (3) feet to any lot line, except where two (2) residential driveways coincide along the same lot line.

The minimum corner clearance from the curb line or edge of pavement of intersecting streets shall be at least twenty (20) feet from the point of tangency of the radius curvature, or twenty (20) feet from the intersection of right-of-way lines, whichever is greater. The radius of the driveway shall not encroach on the minimum corner clearance.

6.5.6 Alignment and Grades

Residential driveway access alignment and grades shall comply with the standards and specifications outlined in the UDO.

6.5.7 Sight Distance

Adequate sight distance should be provided at all driveway access points and shall be in accordance with the standards provided in the manual, “Policy on Street and Driveway Access to North Carolina Highways,” as adopted and amended by NCDOT.

6.5.8 Plot plan criteria for Driveway approvals

- Property lines and dimension of the subjects lot, if not to scale
- Show location of residential structure

- Locate and dimension all existing and proposed driveways, and their radii. Residential driveways are required to be per table **XXX** wide and perpendicular to the street within the right-of-way
- The driveway must be a minimum 18 feet in length as measured from the right-of-way line to the face of the garage or structure
- Label street name and dimension street of right-of-way(s)
- For corner parcels, a minimum of 20 feet is required for the minimum corner clearance from the point of tangency from intersection radius to the driveway edge of pavement
- Driveway must be set back a minimum of 3 feet from the side lot line .
- For more than one driveway on a single lot, a spacing of at least 20 feet is required from any other driveway on the same lot
- Show and dimension any existing curb and gutter, and existing sidewalk
- Plans shall bear the Note: "ALL CONSTRUCTION SHALL BE PER CITY OF RALEIGH AND/OR NCDOT STANDARDS AND SPECIFICATIONS."
- Show recorded sight distance triangles or sight easements across the property frontage

6.5.9 Commercial Driveway Access

Commercial driveway access to and from streets shall be constructed in accordance with the standards and specifications provided in the manual, “Policy on Street and Driveway Access to North Carolina Highways,” as adopted and amended by NCDOT. Developments should also comply with the provisions described in Section 4.12 of this manual.

For any development, the number of driveway access points may be restricted where it is necessary for purposes of decreasing traffic congestion or hazards. These restrictions may include required common access points. Any required cross access documents shall be recorded by map and easement document prior to any permit issuance.

6.6 GUIDELINES FOR DRIVEWAY ACCESS POINTS ALONG THOROUGHFARE ROADWAYS

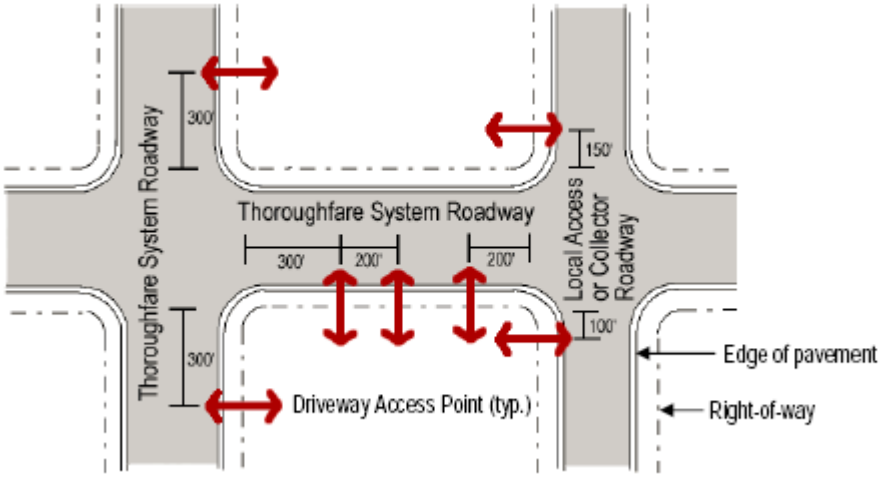
6.6.1 Number of Driveway Access Points

All lots, parcels, or any other division of land of four hundred (400) linear feet or less adjacent to a thoroughfare system roadway should have no more than one (1) driveway access point connected to the thoroughfare system roadway. All lots greater than four hundred (400) linear feet adjacent to a thoroughfare system roadway should have no more than one (1) driveway access point onto the thoroughfare system roadway for each four hundred (400) linear feet adjacent to the thoroughfare

system roadway. For instance, a lot with six hundred (600) linear feet adjacent to a thoroughfare system roadway should be permitted no more than one (1) driveway access point, while a lot with nine hundred (900) linear feet adjacent to a thoroughfare system roadway should be permitted no more than two (2) driveway access points.

6.6.2 Location of Commercial Driveway Access Points on Collector and thoroughfare streets

Location guidelines for driveway access points along collector and thoroughfare system roadways are illustrated in Figure 13. If access to a lot, parcel, or any other lawful division of land is physically unobtainable under the provisions illustrated in Figure 13, driveway access points are to be located the greatest distance possible from one another and from other public and private streets. All driveway design and construction must comply with this manual.



6.7 Curb and Gutter

All public roadways inside the corporate limits of the City, and outside the City when water or sewer is connected to the City utility system, shall be constructed with curbs and gutters.

Curbs and gutters shall be a combination curb and gutter or such other construction approved by the City. Rolled or valley-type curbs are permitted for new collector, residential collector, residential or minor residential streets if all the following are met:

1) Where any existing street containing a standard curb and gutter is to be extended, the curb and gutter shall be extended to at least the next intersection.

2) Curb treatments shall be the same on both sides of a street, but a different treatment may be used adjoining a median.

3) At the interface of differing curb or shoulder treatments, drainage structures are to be installed to assure uninterrupted flow of storm water between the two drainage systems.

Curb and gutter will not be required on the following streets:

1) Sensitive area thoroughfares or roadways located within a Reservoir Watershed Protection Area Overlay District. Curb and gutter may be required where right-of-way is restricted or where needed to control stormwater erosion and sedimentation.

2) Roadways other than thoroughfare system roadways that were inside the City limits and paved prior to 1950.

3) Where curb and gutter is not planned to be installed in the future as part of design plans on street improvements, or where none is required as part of a City Council approved Neighborhood Plan.

6.8 Roadway Layout

Roadway layout, Block perimeters, street extensions and stub streets shall be in accordance with Chapter 8 of the UDO

6.9.1 Street Intersection Design

Reference Table 7 describes optimal street spacing guidelines. To achieve the optimal level of connectivity and street spacing shown in Table 4.2, a variety of street network patterns can be implemented.

TABLE 7 Street Hierarchy and Spacing Guidelines

Prior Classification	Street Typologies	Optimal Street Type Spacing	Optimal Cross-Street Spacing
Primary Arterial	Parkway (4-6 lane), Multi-Way Boulevard (6 lane)	4-6 miles	1-2 miles

Secondary Arterial, Sensitive Parkway	Parkway (4 lane), Multi-Way Boulevard (4-6 lane), Avenue (6-lane)	4-6 miles	1/2 mile
Major Thoroughfare	Avenue (6 lane), Avenue (4 lane, no parking)	1 mile	1/4 mile
Minor Thoroughfare	Avenue (3-4 lane), Main Street (2-3 lane)	1 mile, alt. with C	300 - 600'
Collector, Sensitive Avenue	Avenue (2-lane), Main Street (2-lane), Industrial Street Local Streets (Mixed)	1/4 mile (1200')	300 - 600'
Local, Sensitive Residential Street	Local Streets (Residential)	150 - 600'	150 - 600'

6.9 Cul-de-sac Design

Minimum dimensions for circular cul-de-sac streets are shown in Figure 7. Alternative turnaround designs on residential streets serving six (6) dwelling units or less may be considered on a case-by-case basis. Alternative designs must readily accommodate emergency vehicles and sanitation trucks.

Medians may be permitted where the cul-de-sac radius is increased and it can be demonstrated that emergency vehicles and sanitation trucks can be accommodated. The City will not maintain landscaped medians and a private maintenance agreement for the median shall be required to be approved by the City Attorney.

6.10 Horizontal Street Design

Design criteria for design speed, centerline radius, reverse curve tangent distance and maximum superelevation rates for streets are summarized in Table 8 Superelevation rates, minimum runoff lengths and methods of distribution should be in accordance with *AASHTO* guidelines.

The minimum tangent length of an approaching intersection should be fifty (50) feet for local access system streets. All higher system streets shall have a tangent section no less than one hundred (100) feet approaching the intersection. Tangent lengths shall be measured from the intersection of the two rights-of-way.

6.11 Vertical Street Design

Wherever practical, streets should follow the existing contours of a site so as to avoid excessive grading and removal of existing vegetation. Street grades shall not be less than three-quarters of one percent (0.75%). Standards for vertical street design are listed in Table 8.

At signalized intersections, the maximum grade approaching the intersection should not exceed two (2) percent and extend a minimum distance of two hundred (200) feet in each direction measured from the outside edge of travel way of the intersecting street. For intersections not controlled by a traffic signal, the maximum grade approaching the intersection should not exceed five (5) percent and extend a minimum distance of 100 feet in each direction.

HORIZONTAL AND VERTICAL ALIGNMENT DESIGN CRITERIA

New Street Classifications	Design Speed (mph)	Min. centerline Radius (feet)	Max. Rate of Superelevation for Min. CL Radius (ft per ft)	Min. tangent b/w reverse curves (feet)	Maximum Gradient * (%)	Min. Vertical Curve Length ** (feet)	Minimum rate of vertical curvature, K (LF per % of A ***)	
							Crest	Sag
Sensitive Area Streets								
1. Sensitive Area Parkway	50	930	0.04	400	7	150	84	96
2. Sensitive Area Avenue	40	535	0.04	250	8	125	44	64
3. Sensitive Area Residential Street Collector	35	375	0.04	200	9	100	29	49
4. Sensitive Area Residential Street Local	25	150	NA	0	12	50	12	26
Local Street								
1. Neighborhood Yield	25	150	NA	0	12	50	12	26
2. Neighborhood Local	25	150	NA	0	12	50	12	26
3. Neighborhood Street (Collector)	35	375	0.04	200	9	100	30	50
4. Multifamily Street	35	375	0.04	200	9	100	30	50
Mixed Use Streets								
1. Avenue 2 Lane Undivided	30	250	0.04	150	9	100	19	37
2. Avenue 2 Lane Divided	35	375	0.04	200	8	100	30	50
3. Avenue 3 Lane Parallel Parking	40	535	0.04	250	8	125	44	64
4. Main Street Parallel Parking	30	250	0.04	150	9	100	19	37
5. Main Street Angular Parking	30	250	0.04	150	9	100	19	37
Major Streets								
1. Avenue 4 Lane, Parallel Parking	40	535	0.04	250	8	125	44	64
2. Avenue 4 Lane, Divided	40	535	0.04	250	8	125	44	64
3. Avenue 6 Lane Divided	50	930	0.04	400	7	150	84	96
4. Multi Way Boulevard, Parallel Parking	40	535	0.04	250	8	125	44	64
5. Multi Way Boulevard, Angular Parking	40	535	0.04	250	8	125	44	64
Industrial and Service Streets								
1. Industrial Street	35	375	0.04	200	9	100	29	49
2. Alley, Residential	20	75	NA	0	12	50	12	26
3. Alley, Mixed Use	20	75	NA	0	12	50	12	26
Accessways								
1. Primary Internal Access Drive	25	150	NA	0	12	50	12	26

Note: * the minimum gradient on streets shall be at least 0.75% ** All vertical curves must be symmetrical parabolic curves *** A = the algebraic difference in vertical curve grades

6.12 Sight Distance

Sight distance is the length of roadway ahead visible to the driver. The minimum sight distance available on the roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

The method of measuring stopping sight distance along a roadway is illustrated in Figure

Minimum stopping sight distances, as shown in Table XXX, shall be provided in both the horizontal and vertical planes for planned roadways as related to assumed driver's eye height and position.

6.12.1 Stopping Sight Distance

Where there are sight obstructions (such as walls, cut slopes, buildings and other hazards) on the inside of curves, changes in roadway alignment may be required to obtain adequate stopping sight distance if the sight obstruction cannot be removed.

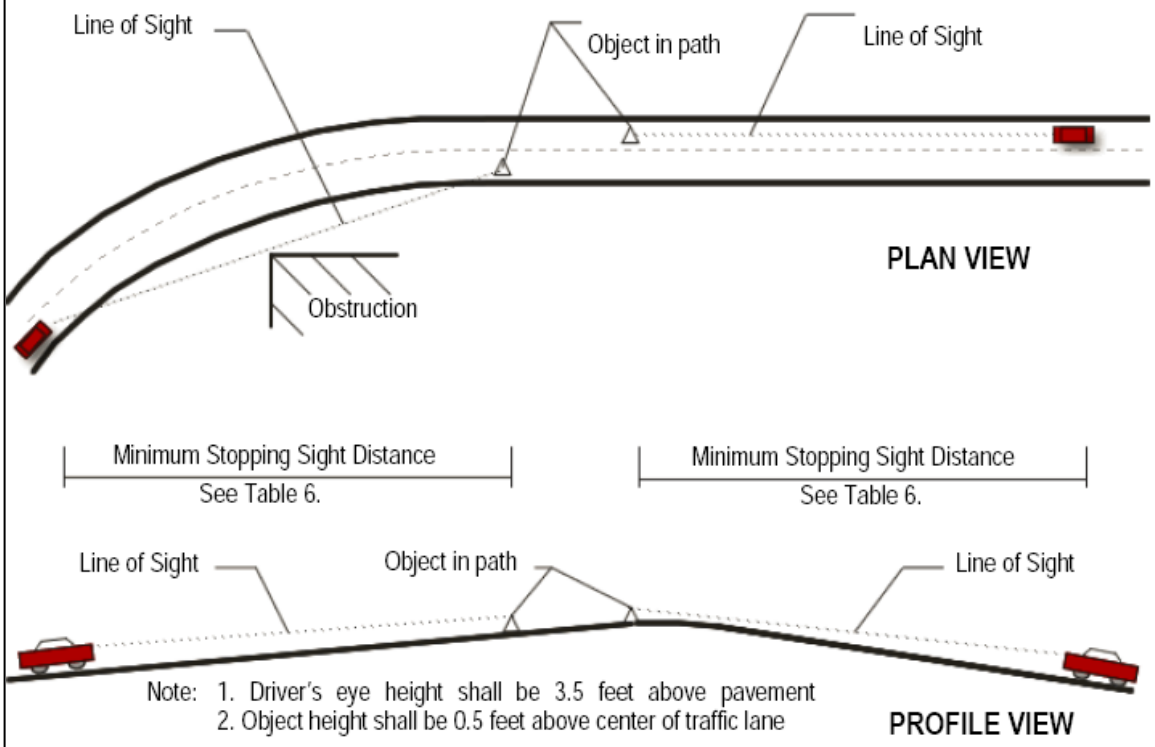
Table 9 Stopping Sight Distance Table

	Minimum stopping sight distance (ft), Street grade in percent						
Operating speed (mph)	**Upgrades**			**Flat**	**Downgrades**		
	9%	6%	3%	0%	-3%	-6%	-9%
25	140	145	150	155	160	165	175
30	180	185	200	200	205	215	230
35	225	230	240	250	260	275	290
40	270	280	290	305	315	335	355
45	320	330	345	360	380	400	430
50	375	390	405	425	450	475	510

Graphic 4

Note: See Figure XX for illustration of sight distance measurements.

Source: A Policy on Geometric Design for Highway and Streets, American Association of State Highway and Transportation Officials, 2011 edition.



6.12.2 Intersection Sight Distance

Intersections should be planned and located to provide as much sight distance as possible. A basic requirement for all controlled intersections is that drivers must be able to see the control device well in advance of performing the required action. Stopping sight distance on all approaches is needed as a minimum. Obstruction-free sight triangles shall be provided in both the horizontal and vertical planes, as related to assumed driver's eye height and position.

At any intersection of two roadways, a sight triangle, as illustrated in Figure 9, shall be provided for an unobstructed path of sight. The sight distance triangle can be defined by connecting a point that is along the minor street's edge of pavement and fifteen (15) feet from the edge of pavement of the major street, with a point that is distance (L) along the major street's edge of pavement.

Table 7 summarizes the required sight distance (L) along the major road for a stopped vehicle on the minor street to cross the major street. If a roadway is divided with a median width of twenty (20) feet or more for passenger vehicle crossings, or forty (40) feet or more for truck crossings, the required sight distance may be based on a two-stop crossing and consideration given to the width of each one-way pavement at a time.

Table 10 Intersection stopping sight distance table

Speed limit (mph)	**Minimum Intersection Sight Distance (ft)**							
	2 Lane Undivided		**3 Lane Undivided or 2 Lane Divided w/ 12' median**		**4 Lane Undivided**		**5 Lane Undivided or 4 Lane Divided w/ 12' median**	
	LEFT TURN	RIGHT TURN	LEFT TURN	RIGHT TURN	LEFT TURN	RIGHT TURN	LEFT TURN	RIGHT TURN
20	230	200	240	200	250	200	270	200
25	280	240	300	240	320	240	340	240
30	340	290	360	290	380	290	400	290
35	390	340	420	340	440	340	470	340
40	450	390	480	390	500	390	530	390
45	500	430	530	430	570	430	600	430

50	560	480	590	480	630	480	670	480
55	610	530	650	530	690	530	730	530

1. The sight distances shown in this chart shall be considered approximate only for a passenger car to turn onto the major street from a side street grade of 3% or less.

2. The distances from this chart are measured along the CL of the roadway (Sight Distance Length L from illustration).

3. The sight line (or resulting sight distance easement line if outside r/w) shall begin at the driver's eye approximately 15' from EP and end at the center of the closest oncoming lane.

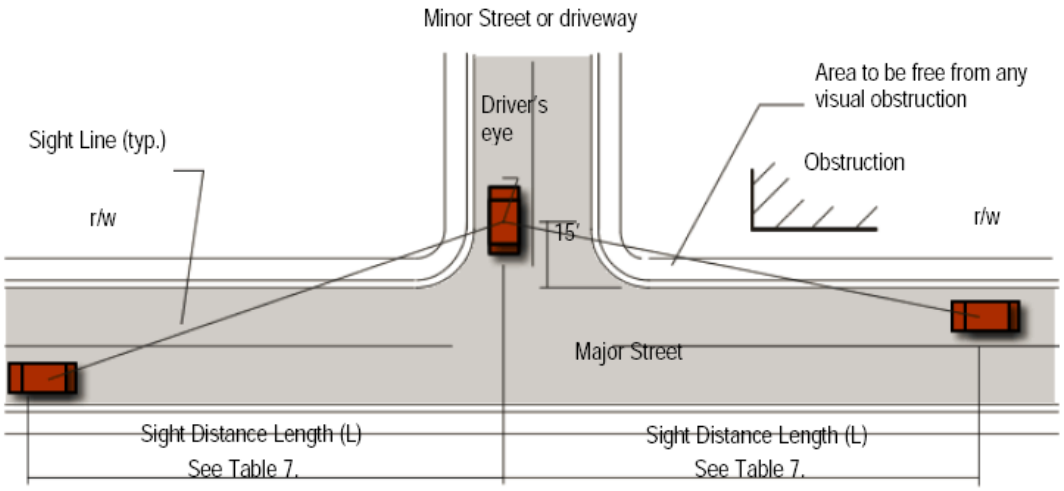
4. Depending on specific site conditions additional adjustments may be required to sight distances. These factors may include, but are not limited to, side street approach grades greater than 3%, median widths of the crossing street, skewed intersections, or other variables that would affect sight distances.

5. Any adjustments to the above sight distances shall be in accordance with section "9.5.3 Intersection Control" of the AASHTO manual (2011) or latest edition.

Graphic 5

Note: This table summarizes the required sight distance along major streets for a stopped vehicle to cross the major street. If located on a divided facility, the median width is not accounted for in this table. Where the median width is 20 feet or more for passenger vehicle crossings, or 40 feet or more for truck crossings, the required sight distance may be based on a two-stop crossing and consideration given to the width of each one-way pavement at a time. See Figure 9 for illustration of sight distance measurements.

Source: City of Raleigh Sight Distance Policy, 1991.



Note 1. Driver's eye height shall be 3.5 feet above the pavement for passenger vehicles and 6.00 feet above the pavement for trucks
2. Driver's eye shall be placed 15' from the edge of pavement.
3. Object height (approaching vehicle) shall be 4.25 feet above the center of traffic lane

6.12.3 Sight Distance Note applicable to all Plans

Within the area of above defined sight triangle, there shall be no sight obstructing or partly obstructing wall, fence, sign, foliage, berming or parked vehicles between the heights of twenty-four (24) inches and eight (8) feet above the curb line elevation or the nearest traveled way if no curbing exists.

6.12.4 Objects permitted in the Sight Distance Triangle

Objects, which may be located in the sight triangle, are items such as; hydrants, utility poles, utility junction boxes, and traffic control devices provided these objects are located to minimize visual obstruction.

6.13 Transition and Roadway Design

When constructing a street that will directly connect with an existing street of different width, it is necessary to install a transition taper between the two.

The length of taper depends upon the offset differences between the outside traveled edge of the two sections and the design speed of the roadway. Formulas for determining transition taper lengths are shown below:

STREET WIDTH TRANSITION TAPERS

For speeds <= 40 mph $L = \frac{W * s^2}{60}$

For speeds >= 40 mph $L = W * S$

Where,

L = transition taper length

W = width of pavement offset, feet

S = roadway design speed, mph

When tapers are located on a curve, the separate halves of the roadway should be designed with different curves to create the taper without any angle points in the curvature.

6.13.1 Warrants

Additional pavement surfaces to accommodate turning movements shall be required and constructed at intersections to the standards specified.

Table 2. Left Turn Lane Warrants for Two-Lane Roadways

OPPOSING VOLUME (veh./hr.)	ADVANCING VOLUME (veh./hr.)			
	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
40-mph Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
50-mph Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
60-mph Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

Note: For operating speeds not shown, interpret between given values.

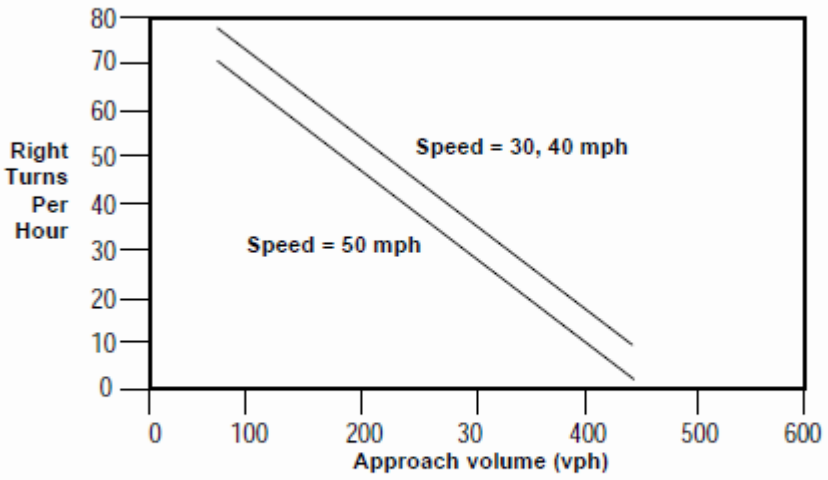


Figure 1. Right-turn / Deceleration Lane Warrants

(1) Left-turn lane – signalized intersections

a. Where fully protected left turn phasing is provided or;

b. Where peak-hour left-turn volumes exceed 100vp

c. Where delay caused by left-turning vehicles blocking through vehicles would reduce the operating capacity of the intersection below level of service “D” (LOS D), as defined in the “Highway Capacity manual, 2000”.

(2) Right-turn lane – signalized intersections

An exclusive right-turn lane shall be provided where the right turning volumes exceeds 300 vph and the adjacent through lane volume also exceed vph per lane. When calculating the adjacent through lane volume, it should be assumed that ll through lanes have equal volumes.

(3) Left turn - unsignalized intersections

A separate left turn lane shall be provided on a two lane roadway, depending on the percent of left turning vehicles in the advancing volume against opposing volume.

For four lane roadways or greater in width, a separate left turn lane should be provided when delay caused by the left turning vehicles blocking through vehicles, would reduce operating capacity of the intersection below level of service D as defined in the Highway Capacity Manual 2000.

(4) Right turn - deceleration lane unsignalized intersections

A separate turn / deceleration lane shall be provided depending on the roadway’s single lane volume, the volume of the right turning vehicles and the posted speed of the roadway.

(5) Additional Turning lanes

The City may require additional turning lanes and tapers or other improvements when it believes that the absence of such improvement will create and unsafe condition or would reduce the operating capacity of the intersection below level of service “D” as defined in the Highway Capacity Manual 2000.

6.13.2 Collector and Thoroughfare Improvements

Complete collector and thoroughfare improvements, in conformance with the minimum roadway design cross-sections shall be made by developments along ht entire length of a thoroughfare system roadway, if any of the following two conditions exist:

(1) A development is located within 400' of an existing or proposed intersection of either 2 thoroughfare system roadways or a thoroughfare system roadway and a collector street system roadway and the improvement can be utilized by motorists as a travel lane or turning lane to improve vehicle delay, congestion or safety.

(2) The improvement would be an extension of an already existing widened section of roadway and the improvement can be utilized by motorists as a travel lane or turning lane to improve vehicle delay, congestion or safety.

Partial thoroughfare improvements, in conformance with the minimum paving construction standards and additional pavement surfaces to accommodate turning movements will be required in the event complete thoroughfare improvements are not required as conditioned in the preceding paragragh.

6.13.3 Turning Lanes

It may be necessary to construct turning lanes for right and left turns into a driveway or street for safety and capacity reasons or where roadway speeds and traffic volumes are high or if there are substantial turning volumes. The purpose of a separate turning lane is to expedite the movement of through traffic, increase roadway capacity, permit the controlled movement of turning traffic, and promote the safety of all traffic. Design elements, which make up a turning lane, are shown in Graphic 6.

Turn lanes should be twelve (12) feet in width; however, the lane width may be reduced to be compatible with the adjacent roadway lane width. In no event shall the turn lane width be less than ten (10) feet.

Graphic 6

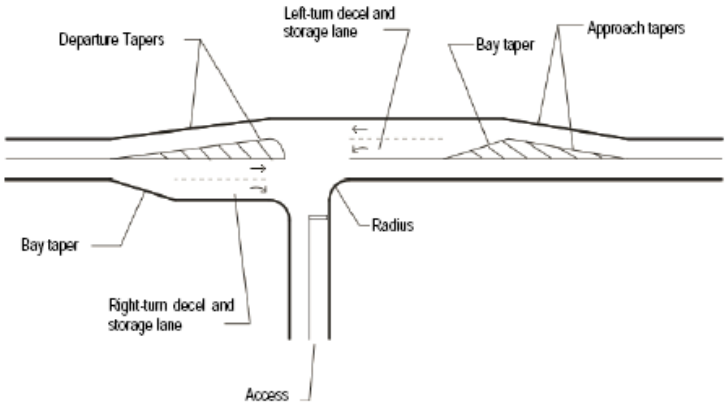


Figure 10. Turn Lane Design Elements

6.13.4 Total Length of Turn Lane

A separate turning-lane consists of a taper plus a full width turn lane. The design of the lane is based primarily on the speed at which drivers will turn into the lane, the speed to which drivers must reduce in order to turn into the driveway or side street after traversing the deceleration lane, and the amount of vehicular storage that will be required.

The total length of the turning lane and taper should be determined by either: (1) the combination of turn lane or through lane queue storage plus the bay taper, or (2) right-turn / deceleration requirements, whichever is the greatest.

6.13.5 Turn Lane Storage -- Signalized Intersections

Where traffic is to be controlled by a traffic signal, the turn lane should be of sufficient length to store the turning vehicles and clear the equivalent lane volume of all other traffic on the approach, whichever is the longest. This length is necessary to ensure that full use of the separate turn lane will be achieved and that the queue of the other vehicles on the approach will not block vehicles from the turn lane.

The storage requirements for turn lanes should be based upon the peak 15-min. flow rates of turning traffic. The average number of turns per cycle can then be multiplied by a factor to account for random variations in arrivals. The length of turn lane can be estimated by the following formula:

$$L = \frac{V * K * 25 * (1+p)}{N}$$

Where,

L = storage length of turn lane, feet

V = peak 15-min. flow rate approaching vehicles, vph

K = constant to reflect random arrivals

K = 2 for 95% probability of storing all vehicles

K = 1.5 for 90% probability of storing all vehicles

25 = approximate length of vehicle, feet per vehicle

p = percent of trucks or busses (use 5% if unknown)

N = number of cycles per hour

The storage requirement for a separate turn lane is also based on the amount of queue length necessary to accommodate other vehicles arriving on the approach during the red phase of the cycle. The "red time" formula for estimating the storage length for other vehicles is as follows:

$$L = \frac{V * K * 25 * (l - g/C)}{(N * l)}$$

Where,

L = storage length of turn lane, feet

V = peak 15-min. flow rate approaching vehicles, vph

K = constant to reflect random arrivals

K = 2 for 95% probability of storing all vehicles

K = 1.5 for 90% probability of storing all vehicles

25 = approximate length of vehicle, feet per vehicle

g = green time, seconds

C = cycle length, seconds

N = number of cycles per hour

l = number of approaching vehicle lanes

6.13.6 Turn Lane Storage – Non-signalized Intersections

The storage length for turning vehicles at intersections not controlled by a traffic signal should be determined by using the formulas for signalized intersections as outlined above. Storage requirements should be based on an assumed minimum cycle length of 90-seconds.

6.13.7 Right-Turn / Deceleration Lengths

The lengths required to come to a stop from either the design speed or an average running speed of a roadway, are indicated in Table 11. The lengths assume the roadway is on a two percent (2%) or less vertical grade. The desirable deceleration lengths should be used on new roadways and the minimum may be used along existing roadways. Longer deceleration lengths may be required on downgrades greater than two percent (2%).

Table 11

Design speed (mph)	Right turn/ Deceleration length (feet)	
	Desirable (1)	Minimum (2)
30	235	185
35	270	240
40	315	295
45	375	350
50	435	405
55	480	450

Notes:

(1) Assumes stop condition

(2) Assumes 15 mph speed differential

6.13.8 Tapers

Approach, departure and bay taper length for separate turn lanes shall be based on the following formulas:

Approach and Departure Taper

For speeds <= 40 mph $L = \frac{W * s^2}{60}$

For speeds >= 40 mph $L = W * S$

Bay Taper

$L = \frac{W * S}{3}$

6.14 INTERSECTION DESIGN AND OPERATIONS

Streets should intersect at or as near ninety (90) degrees as possible, but no less than seventy-five (75) degrees. Intersections with more than four legs should be avoided whenever possible.

6.14.1 Traffic Control Devices

All traffic control devices should be designed in accordance with the guidelines as published in the *Manual on Uniform Traffic Control Devices (MUTCD)*, 2009. The typical intersection control shall be two-way stop control, which provides stop control on the side-street intersection approaches and free flow on the main street.

All-way stop control may be provided at intersections where traffic volumes or other conditions are consistent with the warrants set forth in the MUTCD. Signal control may only be provided at intersections where vehicle or pedestrian volumes meet the thresholds set forth for new signals in the MUTCD.

A roundabout may be constructed at any intersection location where it may be desired in order to enhance intersection capacity, reduce vehicle speeds along a corridor, or enhance intersection aesthetics. Roundabouts shall be designed in accordance with the criteria set forth in *Roundabouts: An Informational Guide,* 2nd Edition, 2010. hyperlink? Care should be taken in order to ensure roundabouts

are not located in close proximity to adjacent stop or signal controlled intersections where long queues may back up into the roundabout.

6.14.2 Curb Return Radii

Public street Intersections shall provide appropriate curb radii in order to allow the design vehicle to safely complete a turn without encroaching on adjacent Streetscape elements, including sidewalks and landscaping. Radii may accommodate the control vehicle with centerline encroachment for low volume roadways; however the design vehicle should be accommodated within the appropriate travel lane(s). Designers should prepare Autoturn analyses in order to verify that intersections may accommodate the design and control vehicles.

Designers should take into account bicycle lane width and parking lane width when designing curb radii, as the travel lane offset allows for a larger effective radius for large vehicles. When a design vehicle larger than a Passenger Vehicle (P) is used and there are multiple receiving lanes, the design should account for the ability of the turning vehicle to use all receiving lanes.

Where on-street parking lanes are provided, curb extensions (bulbouts) may be considered, reducing the effective crosswalk width for pedestrians. This may have an effect of increasing the required curb radius however, so care should be taken to account for the relevant design vehicle.

Where intersection radii larger than 25 feet are required in order to accommodate large vehicles, designers should consider incorporating mountable curbs, truck aprons, or channelized turn lanes in order to minimize the impact to intersection width for pedestrians.

The following vehicle types should be used to design back of curb radii or other elements of design at intersections of roadways:

Table 2 Design Vehicle Type

Street Typology	Radius	Design Vehicle
Alley	n/a	Single Unit Truck (SU-30)
Local Streets	28’	Passenger Car (P) or Single Unit Truck (SU-30)
Mixed Use Streets	28’	Single Unit Truck (SU-30)
Major Streets	28’	Intermediate Semi-Trailer (WB-40) or Interstate Semi-Trailer (WB-62)

Industrial Streets	28’	Interstate Semi-Trailer (WB-62)

6.14.3 Pavement Markings

When a development is required to improve roadways, the developer shall be required to install pavement markings on the surface of thoroughfare or collector street system roadways. Other roadways will be considered on a case-by-case basis. Pavement marking plans and installation should be in conformance with NCDOT standards and specifications.

6.15 Private Streets

6.16.1 General

1. No new private streets are allowed, except for alleys.

2. All existing private streets must remain under maintenance of the homeowners' association and must be maintained to equivalent public street standards.

6.15.2Traffic Flow

It shall be the responsibility of the homeowners' association to establish speed limits and to maintain uninterrupted traffic flow along all private streets. If it is necessary for "no parking" signs to be erected, for street lights to be installed, for repairs to be made or towing of vehicles to be undertaken, this is all to be done at the expense of the homeowners' association.

6.15.3 Street Signs

All streets must contain identification as required in Chapter 7 of the UDO.

6.16 Parking

6.16.1 Parking Lot Design and Layout

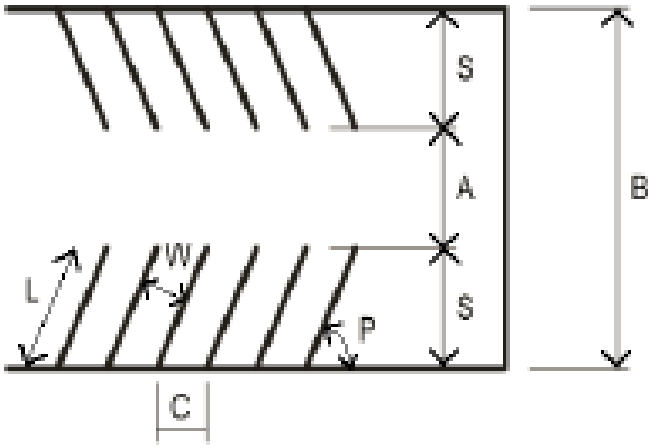
Parking lots should be designed to provide for safe pedestrian and vehicular circulation.

Pedestrian flow should provide for as few conflicts with vehicle traffic as possible.

Required parking spaces shall be arranged and sized in accordance with the regular and compact parking space design schedules shown in Figure XXX Stall depths and module widths shall be measured to the face of curb or to the edge of pavement if curbing is not used.

Handicap parking spaces shall be designed and delineated in accordance with the standards outlined in the publication titled, "*North Carolina Building Code Chapter 10 and 11 and ANSI A 117.1.* Parking lots should also be signed and maintained with appropriate traffic control devices and pavement markings so as to regulate the safe movement of vehicles and pedestrians within the parking area.

Graphic 7 Parking Lot Layout



P = Parking Angle, degrees
C = Curb Width, foot
S = Stall Depth, foot
L = Stall Length, foot

W = Stall Width, foot
A = Aisle Width, foot
B = Module Width, foot

Regular Space Parking Area Design

Parking Angle (P)	Curb Width (C)	Stall Depth (S)	Stall Width (W)	Aisle Width (A)	Module Width (B)
90	8.5	18.0	8.5	24.0	60.0
75	8.8	19.6	8.5	23.0	62.2
60	9.8	19.8	8.5	14.5	54.1
45	12.0	18.7	8.5	12.0	49.4
30	17.0	16.4	8.5	12.0	44.8
0	22.0	8.0	8.5	12.0	28.0
L = 18.0 feet					

Compact Space Parking Area Design

Parking Angle (P)	Curb Width (C)	Stall Depth (S)	Stall Width (W)	Aisle Width (A)	Module Width (B)
90	7.5	15.0	7.5	24.0	54.0
75	7.8	16.5	7.5	23.0	56.0
60	8.7	16.8	7.5	14.5	48.1
45	10.6	15.9	7.5	12.0	43.8
30	15.0	14.0	7.5	12.0	40.0
0	19.0	7.5	7.5	12.0	27.0
L = 15.0 feet					

Modifications to Graphic 7 may be made in accordance with the following:

1) A reduction in aisle width in parking decks and other structures if there is a compensating increase in the stall width.

2) Reductions in aisle width, the utilization of stacked parking stalls, or other changes to access or dimension of parking areas if parking is performed on a continuing basis by paid employee attendants.

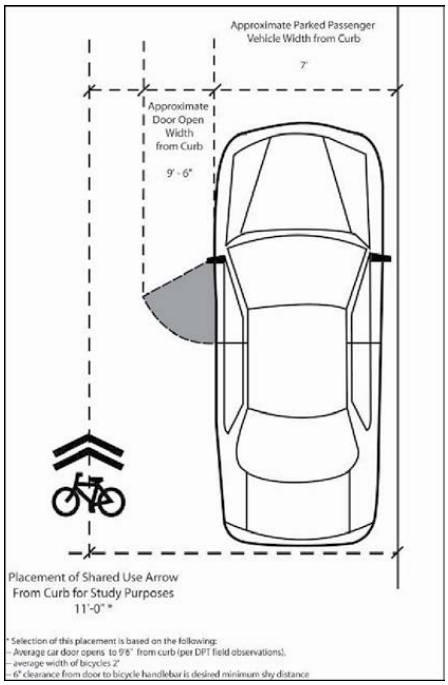
3) Allowance of stacked parking stalls, where each stall does not have access to an aisle or street, if the parking area is specifically designed and designated in the field to serve a particular dwelling unit in a planned development. The parking stall may be located in a garage, carport, or other enclosed space.

6.16.2 On Street Parking

On-street parking acts as buffer between moving vehicles and pedestrians. It requires approximately half the surface area of off-street parking as aisles are multi-purpose and integrated in the travelway. Many of the street typologies for urban contexts illustrated in this Manual and articulated in the UDO incorporate on-street parking as an important design element.

Graphic 8 – *Parallel*

Parallel parking may be provided in both residential and commercial contexts; however, wider spaces are required within commercial districts to accommodate higher expected turnover. Configurations are detailed in Section 4 for each roadway typology.



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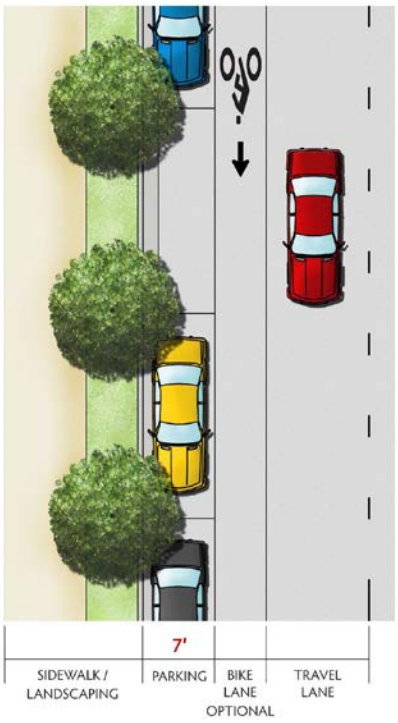
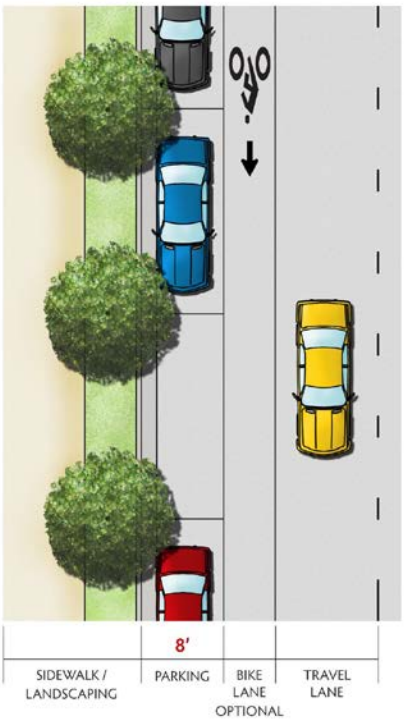
The door zone extends 2.5 - 3' from the side of the vehicle. Adjacent bicycle facilities should extend at least 3' beyond this.

PARALLEL PARKING OPTIONS

RESIDENTIAL STREET

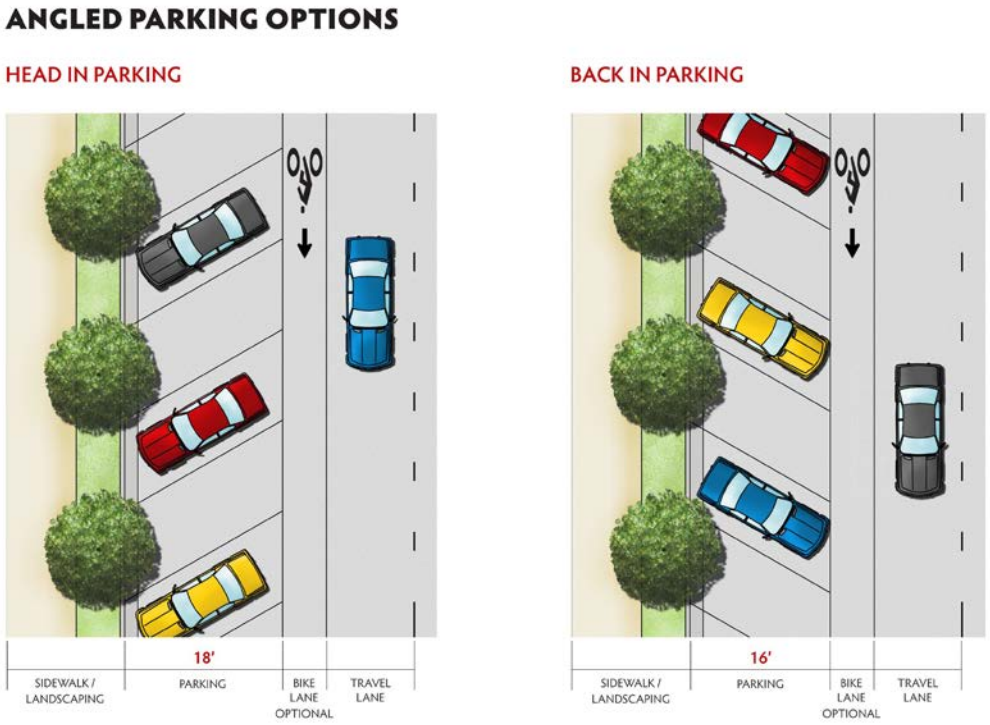


COMMERCIAL STREET



6.17.3 Angled Parking

Angle parking spaces should be provided at a 60 degree angle to the curb line. The stall projection measured perpendicular to the curb line should be 18 feet for head-in angle parking spaces and 16 feet for back-in angle parking spaces. Stall widths should be a minimum of 8'-6", measured perpendicular to the stall lines.



6.17 Streetscape Design and Operations

Considerations in Streetscape design include sidewalk width, slope, furniture accommodation, utilities, landscaping, and building access. Primary guidance on best practices regarding universal accessibility in the Streetscape is available via the US Access Board's draft Public Right-of-Way Accessibility Guidelines (PROWAG), as approved in 2012, as well as related Americans with Disabilities Act Accessibility Guidelines (ADAAG) for transportation facilities. The information in this chapter is drawn from the aforementioned guidelines, ITE manual on Designing Walkable Urban Thoroughfares, Raleigh UDO, and other resources.

6.17.1 Streetscape

The required streetscape is determined by the zoning district or the designated frontage. The Streetscapes are described in the UDO in Chapter 8. Subdivision & Site Plan Standards, Section 8.5.2.

More information can be found in Section 8.5.2 (Streetscape Types) of the UDO.

- Frontage: The frontages are defined in Article 3.4 (Frontage Requirements) of the UDO. Listed below are the different types of frontages.

  Parkway (-PK)

  Detached (-DE)

Parking Limited (-PL)

Green (-GR)

Urban Limited (-UL)

Urban General (-UG)

Shopfront (-SH)

- Zoning District: The applicable zoning district
- Width: Defines the maximum Streetscape width
- Streetscape: defines all the facilities paled in the area
- General: Defines Walkway type, Planting type and tree spacing

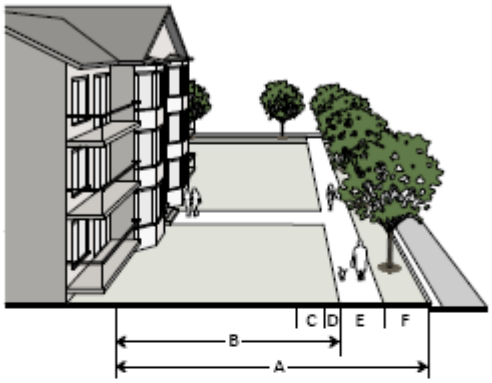
A. Main Street

Frontages	
Applicable frontages	-SH, -UG, -UL, -GR, -PL
Zoning Districts	
Applicable zoning districts	Mixed use districts
Width	
A Streetscape width (max)	35'
Streetscape	
B Sidewalk (min)	10'
C Planting area (min)	6'
General	
Walkway type	Sidewalk
Planting type	Tree grate
Tree spacing	40' o.c. avg

B. Mixed Use

Frontages	
Applicable frontages	-UG, -UL, -GR, -PL
Zoning Districts	
Applicable zoning districts	Mixed use districts
Width	
A Streetscape width (max)	40'
Streetscape	
B Sidewalk (min)	8'
C Planting area (min)	6'
General	
Walkway type	Sidewalk
Planting type	Tree grate / lawn
Tree spacing	40' o.c. avg

C. Commercial



Frontages	
Applicable frontages	-GR, -PL
Zoning Districts	
Applicable zoning districts	Mixed use districts
Width	
A Streetscape width (max)	65'
Streetscape	
B Building setback (min/max)	20' / 50'
C Utility placement	5'
D Maintenance strip (min)	2'
E Sidewalk (min)	6'
F Planting area (min)	6'
General	
Walkway type	Sidewalk
Planting type	Tree lawn
Tree spacing	40' o.c. avg
No on-site parking permitted between the building and the street	

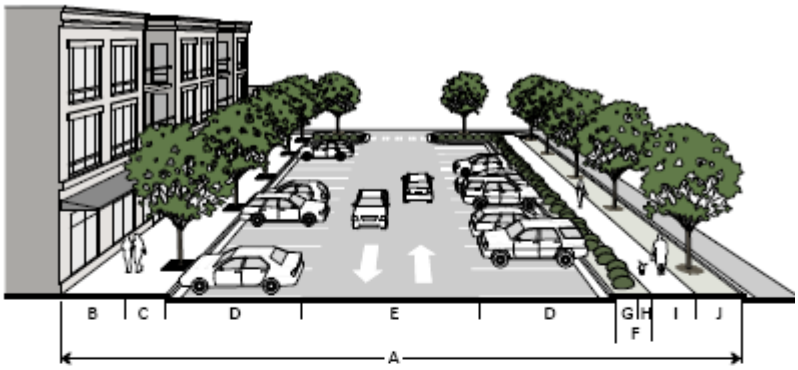
D. Residential

Frontages	
Applicable frontages	-DE
Zoning Districts	
Applicable building types	All districts: detached & attached house
Applicable zoning districts	Residential Districts, MH
Streetscape	
A Building setback (min)	varies
B Utility placement	5'
C Maintenance strip (min)	2'
D Sidewalk (min)	
Typical	6'
Sensitive area	5'
E Planting area (min)	6'
General	
Walkway type	Sidewalk
Planting type	Tree lawn
Tree spacing	40' o.c. avg

E. Multi-Way

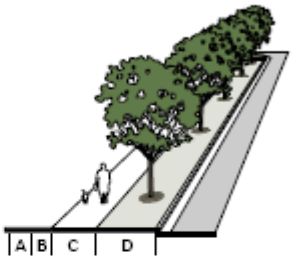
Frontages	
Applicable frontages	-PL
Zoning Districts	
Applicable zoning districts	Mixed Use Districts
Width	
A Streetscape width (max)	65'
Streetscape	
B Sidewalk (min)	10'
C Planting area (min)	6'
D 60° angle parking	18'
E Access lane	11'
F Median (min)	11'
General	
Walkway type	Sidewalk
Planting type	Tree grate / lawn
Tree spacing	40' o.c. avg

F. Parking



Frontages	
Applicable frontages	-PL
Zoning Districts	
Applicable zoning districts	Mixed Use Districts
Width	
A Streetscape width (max)	120'
Streetscape	
B Sidewalk (min)	8'
C Planting area (min)	6'
D 90° head-in parking (min)	18'
E Access lane (min)	22'
F Planting area (min)	10'
G Utility placement	5'
H Maintenance strip (min)	2'
I Sidewalk (min)	6'
J Planting area (min)	6'
General	
Walkway type	Sidewalk
Area F planting type	36" min hedge/wall (see Sec. 7.2.4)
Areas C & J planting type	Tree grate / lawn
Tree spacing	40' o.c. avg

G. Sidewalk and Tree Lawn



Zoning Districts	
Required zoning districts	All districts: Existing streets where no other streetscape applies
Streetscape	
A Utility placement	5'
B Maintenance strip (min)	2'
C Sidewalk (min)	6'
D Planting area (min)	6'
General	
Walkway type	Sidewalk
Planting type	Tree lawn
Tree spacing	40' o.c. avg

6.17.2 Adopted Streetscape Plans

1. In the event an adopted streetscape plan regulates streetscape improvements, the adopted Plan shall control. The adopted streetscape plans are contained within the Raleigh Street Design Handbook.

2. The requirements of this Article are intended to serve as minimum standards. Where a streetscape plan adopted before the effective date of this UDO sets a lower standard, the standard in this Article shall prevail.

3. The City Council may modify an adopted Streetscape Plan following written notice to property owners along the street.

Adopted Streetscape Plans

The following adopted streetscape plans must be followed in place of the streetscape types in Sec. 8.5.2 of the UDO:

a. Cameron Village Streetscape and Parking Plan
b. Cameron Village Streetscape and Parking Plan Amendment
c. Downtown Streetscape Master Plan
d. Glenlake Office Park Streetscape & Parking Plan
e. Glenwood South Streetscape & Parking Plan
f. Hillsborough Morgan Streetscape & Parking

g. Oakwood Mordecai Business District Streetscape Plan
h. Peace Streetscape & Parking Plan
i. Promenade at Crabtree Streetscape & Parking Plan
j. Southeast Raleigh Streetscape Master Plan
k. Stanhope Center Streetscape and Parking Plan
l. University Village Streetscape Plan on Hillsborough Street

2. The requirements of this Article are intended to serve as minimum standards. Where a streetscape plan adopted before the effective date of this UDO sets a lower standard, the standard in this Article shall prevail.

6.18 Street Trees

6.18.1 Street Tree Plantings in an Urban Setting

Cross-reference the City of Raleigh Municipal code Trees and Vegetation, Part 9 Chapter 8 and City Tree Manual. Where the Transportation Manual deviates from the referenced materials the code Part 9 Chapter 8 shall take precedence. The Parks and Recreation Department is responsible for plan review, inspection, monitoring and enforcement associated with tree planting and maintenance on property owned or controlled by the City.

DEVELOPMENT AND LANDSCAPE PLAN REQUIREMENTS

1. The Urban Forester or designee shall review all site plans with trees in the right of way and on city owned or controlled property. This application process describes the requirements for plan review, permitting, tree protection, standard specifications, tree quality, installation and maintenance.

2. Where development abuts a street controlled by the North Carolina Department of Transportation trees may not be required or will fall under the landscape requirements of the state. The city is still required to review and approve all proposed trees in the right of way.

3. **Application Process**

   This is the application process for activities impacting city trees. Impacts include but are not limited to planting, removal, pruning, trenching, boring, excavating, filling, fertilizing, treating for disease or insects, installing decorations and planting.

   a. Submit Tree Impact Permit Request to the Urban Forester
   b. Additional documentation required

      i. Site and/or Landscape Plan

         1. Identify property boundaries and rights of way
         2. Label streets and other plan elements

3. Overhead utilities and lighting plan
4. Identify trees for demolition and preservation
5. Depict the required site distance triangles
6. Depict tree protection zones and fencing detail
7. Tree species including botanical name, installation size and counts
8. Urban tree pit detail and subsurface root treatment if applicable with 600cuft minimum soil requirement.
9. Adherence to tree quality specifications and detail
10. Adherence to tree planting specifications and detail
11. Tree Protection Plan (waived if no trees impacted within *Critical Root Zone* on site)

6.18.2 Tree Infrastructure, Installation and Maintenance Standards

1. Trees in sidewalks, pits and grates and tree lawn

a. Tree grates
   i. 4’ x 6’ gray iron, ADA compliant
   ii. Tree grates shall have a provision for trunk expansion of the tree, such as pop out concentric rings in the grate around the trunk
   iii. No utilities or electrical conduits are permitted within the tree pit or grate (utilities may run below and through the subsurface root expansion infrastructure)
   iv. Trees shall be centered in the pit
   v. Tree pits shall accommodate a depth of 3’ of planting soil
   vi. High quality planting soil shall be used in the pit directly below the grate

Drainage shall be provided

b. Tree Lawn
   i. 6’ wide tree lawn
   ii. Trees centered in area
   iii. No utilities or electrical conduits are permitted within the tree lawn (utilities may run below and through the subsurface root expansion infrastructure)

   iv. 600 cubic feet of organic soil in the immediate area where the tree is to be placed

c. A $600 maintenance fee shall be calculated at the time of permit issuance for each street tree to be installed. This shall be included in the Fee Schedule.

2. Required Subsurface Root Expansion

a. High quality top soil or structural soil shall be used to accomplish the soil volume requirement.

b. Require minimum 600 cuft

c. Exceptions and design alternatives are encouraged to achieve soil volume: Urban Forester review required. Designs that group trees and connect root spaces will be favored as well as the introduction of LID materials and technology

d. Select one or more options below
   i. Structural Soil
   ii. Subsurface Soil containment structure
   iii. Root pathways (must be combined with one other method)
      1. 6 paths from each tree, 3 on each side, 20' minimum extension for each path. Connect to adjacent pit path.
   iv. Suspended pavement

3. Planting Standards

a. All plant material and installation work shall conform to the standards detailed in the following documents:

   i. American National Standards for Tree Care Operations, ANSI A300. American National Standards Institute, 11 West 42nd Street, New York, N.Y. 10036

   ii. American National Standard for Nursery Stock, ANSI Z60.1. American Nursery and Landscape Association, 1250 Eye Street. NW, Suite 500, Washington, D.C. 20005

   iii. Hortus Third, The Staff of the L.H. Bailey Hortorium. 1976. MacMillan Publishing Co., New York

b. All plant material shall be free of all pests, diseases, and cankers, in healthy condition, and free of mechanical damage at the time of planting.

c. Balled and Burlapped (B&B) Street Trees

   i. Trees designated B&B shall be properly dug with firm, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the *American Standard for Nursery Stock ANSI Z60.1*.

ii. Root balls shall be firmly wrapped with nonsynthetic, rottable burlap and secured with nails and heavy, nonsynthetic twine.
iii. The **root collar** shall be apparent at surface of ball, or the contractor will be responsible for removing excess soil from the top of the rootball. The tree shall be planted at grade; no more than 2" above grade and shall not be planted below grade.
iv. Remove all burlap, lacing, and wire basket from at least the top 1/2 of the rootball and discard from planting hole.
v. Do not maneuver by trunk. Handle by root ball only.

d. Containerized material

i. Trees designated containerized shall have firm, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the *American Standard for Nursery Stock ANSI Z60.1*.
ii. The root collar shall be apparent at surface of ball, or the contractor will be responsible for removing excess soil from the top of the rootball. The tree shall be planted at grade; no more than 2" above grade and shall not be planted below grade.
iii. Remove container prior to planting.

e. Installation size for right of way trees

i. 3" caliper, 10' tall for large maturing or shade trees
ii. Understory trees shall be a minimum of 1.5" caliper for single stem and 6' tall for both single and multi-stemmed trees.

4. Maintenance and Warrantee Standards

a. It is the adjacent property owner's responsibility to maintain the mulch ring or tree grate around trees in the right of way and prevent string trimmer or mower damage.

b. A 2 year warrantee and maintenance period is required after the final inspection of permitted planting.

c. Tree Grates

i. Maintain grates free of weeds, trash and debris.
ii. Replenish gravel as needed to maintain an even surface. Gravel shall match existing material; typically gray pea gravel/ #67 washed stone gravel.
iii. Notify Urban Forester if the tree grate is girdling tree or causing damage to tree.

d. Mulch- organic

    i. Mulch shall not exceed 3 inches in depth and will remain a minimum of 3” away from the base of any given tree.
    ii. Mulch shall be the responsibility of the owner.

e. Staking

    i. Do not stake unless the tree becomes unstable or it is a high wind area
    ii. If stability is a concern, remove all staking material after 1 year

f. Watering Instructions

    i. 2 year watering and maintenance required (minimum)
    ii. After installation trees shall be thoroughly soaked and watered at least twice per week until establishment.
    iii. Use a slow flow hose end device and water each tree at the base for several minutes. Commercially available water bags are acceptable but the root ball shall be soaked as well as filling the bag.
    iv. Watering volumes should be based upon delivery of 1” of moisture / week to the tree if precipitation does not meet that amount during the active growing season defined as April 15th through November 1st.

5. Tree Pruning

a. All tree pruning shall be done by or under the supervision of an ISA Certified Arborist or City approved professional.
b. ANSI A-300 Pruning Standards shall be strictly adhered to.

6. Root Pruning

a. Area for root pruning must be approved by an ISA Certified Arborist to prevent a hazardous tree condition.
b. Acceptable methods of cutting are with sharp hand pruners, loppers, handsaw or hydraulic tools. Implement must leave a clean cut.
c. If excavation causes pruned roots over 1.5” in diameter to remain exposed for more than 24 hours, roots on tree side shall be kept moist. Backfill with topsoil, moist mulch, or drape with wet burlap.
d. Where concrete is poured adjacent to pruned roots heavy duty plastic shall be installed against the tree side of the pruned roots to prevent uptake (toxic to tree).

7. Tree Protection

a. Tree protection fencing shall be installed at a minimum radius of the Critical Root Zone

(CRZ) of trees (CRZ defined as radius 1.25' (ft) per caliper inch at dbh from trunk of tree)
b. Signage necessary every 50' *Do Not Enter Tree Protection Area*
c. If construction occurs within the (CRZ) at least 12" of mulch shall be placed and/or logging mats or plywood where machinery maneuvers to reduce soil compaction in this zone.
d. The tree protection fencing shall not be violated for the entire duration of the project without approval from arborist.
e. There will be zero tolerance for storing or parking vehicles, supplies, or equipment under trees.

8. Tree Replacement

a. Trees shall be replaced in the next planting season if they are more than 25% dead, in rapid decline, are infested by insects or disease, have lost the natural shape due to dead branches, excessive pruning including vandalism, inadequate or improper maintenance, or are failing due to other causes.
b. Replacement trees installed after the 1st year of the 2 year warrantee/maintenance period shall get a full 1 year of warrantee/maintenance from the time of planting.
c. Dead, dying, diseased or vandalized trees that are destroyed shall be removed within 15 days.
d. Species may be changed with approval from Urban Forester or designee.

6.19 Transit

6.19.1 Overview

The Capital Area Transit Program (CAT) has the responsibility for providing transit services for the City of Raleigh and surrounding areas. CAT encourages developers and local municipalities to follow guidelines and recommendations set forth in the Passenger Amenity Guidelines and Transit Design Standards Guidebook and to work with CAT staff when planning new developments or changes to existing developments. This teamwork and collaboration will create transit-oriented environments that will meet the City's initiative to foster Complete Streets infrastructure and to support the mandates of the Americans with Disabilities Act (ADA).

6.19.2 Planning Phase

The following questions can be used in planning and evaluating accessibility of a development to public transit and a new or improved bus stop. Proposed developments can be evaluated by the responses provided. A "Yes" response is required and will determine if the proposed development will accommodate transit vehicles and will provide access to public transit. Refer to the Passenger Amenity

Guidelines and Transit Design Standards Guidebook for appropriate layout and design suggestions, if a "Yes" is not received. CAT planning staff will review all development sites and provide transit related design recommendations and technical assistance if additional assistance in required.

_____ Is this a Major Activity Center (hospitals and universities)

_____ Is this a High Density development

_____ Is this a Medium Density development

_____ Is this a Low/Rural Development

_____ Will roadways within and around the development be accessible to buses?

_____ Do radii for driveways and intersections meet bus turning radius designs?

_____ Are roadway lane widths 12' wide?

_____ Is curb and gutter provided?

_____ Are vertical grades 6% or less?

_____ Are residential developments designed with a central collector street that will provide access for buses?

_____ Have bus stop locations near the proposed development been identified by CAT planning staff?

_____ Has CAT planning staff reviewed the proposed transit stop location?

_____ Are passenger amenities such as a shelter or bench required as part of this development?

_____ Are sidewalks, ramps, bus pads and other development features designed to meet ADA guidelines?

_____ Are direct access paths provided from building entrances to the bus stop?

_____ Have the plans been reviewed and approved by CAT planning staff for all transit related amenities?

6.19.3 Design Phase

Once the planning work has been completed and approved by CAT planning staff, design efforts may begin. Construction Standard Drawings, shown on the following pages in Appendix A, T-1 through T-12, are available to assist in the design and layout of required bus stop amenities. Design elements will include the following steps:

1. Provide enough topographic survey information to properly layout the site. Include nearest intersection and/or driveway turnouts to determine if sight distance and clear recovery requirements are in violation. Sight distance and clear recovery requirements will follow the guidelines of the AASHTO "Green Book" - A Policy on Geometric Design of Highways and Streets.

2. Provide utility information and show street rights-of-way and property lines to determine if easements will be required.

3. Provide CAT planning staff with twenty-five percent (25%) design plans with all amenities approved during the planning phase. Design plans should include existing conditions topographic survey to determine grades of pad and surrounding areas meet ADA and if retaining walls are needed.

4. Prepare NCDOT Encroachment Agreements (Form R/W 16.1A) and provide appropriate number of copies of plans to Division for review. Coordinate with NCDOT Division 5, District 1 Office.

5. Prepare Easement Exhibits on legal size sheet, sealed and signed by a North Carolina Registered Surveyor and provide to City Real Estate Department.

6. Provide technical specifications for all construction items to be reviewed by the City to ensure that they meet the current standards.

6.20 Solid Waste Design

This section in the Transportation manual provides guidance for the access standards. Further information can be found in the Solid Waste Collection Design Manual (Part 7, Chapter 2 of the Raleigh City Code).

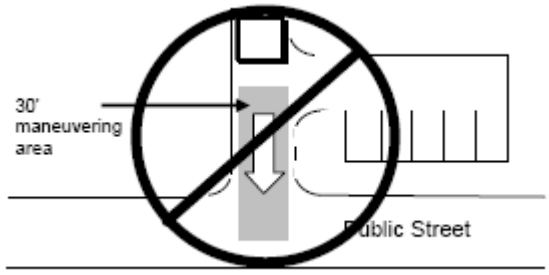
6.20.1 Access Standards

A-1. All parking areas to be directly accessed by solid waste collection vehicles must maintain all Internal inside curb radii at a min. 28'. All parking lot aisles that will be traversed by solid waste

collection vehicles must meet the residential street standard of 8” sub-base and 2.5” asphalt surface. Site plans must designate the ingress and egress routes for solid waste collection vehicles.

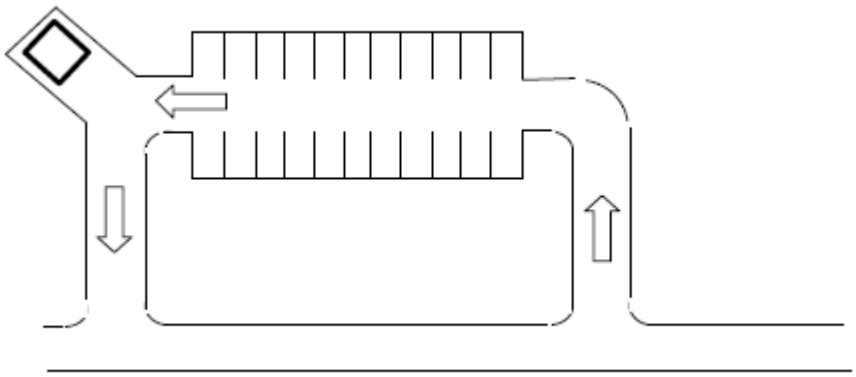
A-2. Access to collection devices must be by internal driveways and parking areas within a site. No collection device may be accessed directly from a public street, and no backing movement from an internal collection device may encroach into a public right of way. Exemption of this condition for properties within the Downtown District may be authorized in writing by the Solid Waste Services Director.

Graphic 11 - A-2



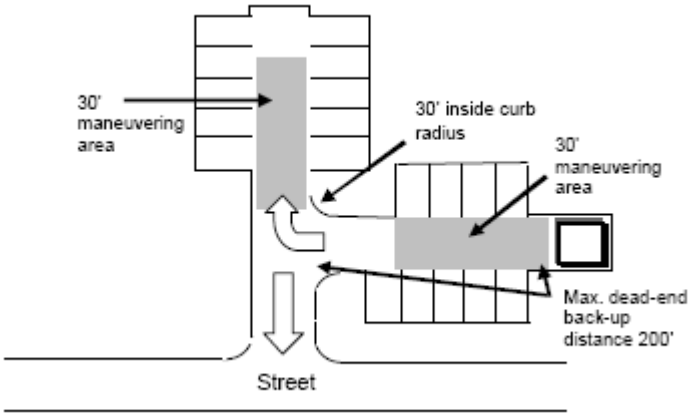
A-3. Parking areas must allow for a circular through movement wherever possible to avoid back-up movements.

Graphic 12 – A-3 Parking Lot Movement



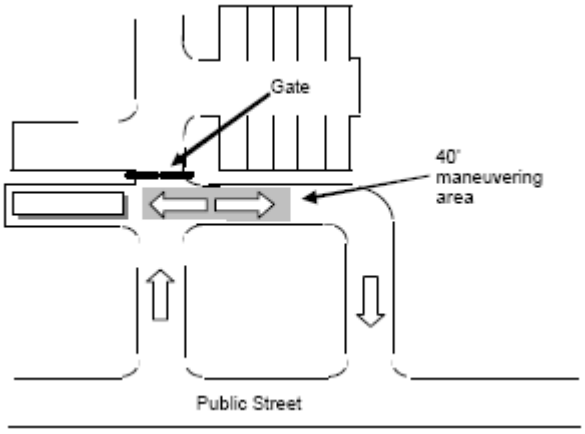
A-4. Where a circular through movement is not possible, maneuvering space in front of any dumpster as noted in C-1 below must be provided (30’ min.). Backup and turnaround space must be in an aisle with a minimum width of 16’ and a depth of 30’, and min. inside curb radius of 28’.

Graphic 13 – A-3 Back-up Configuration



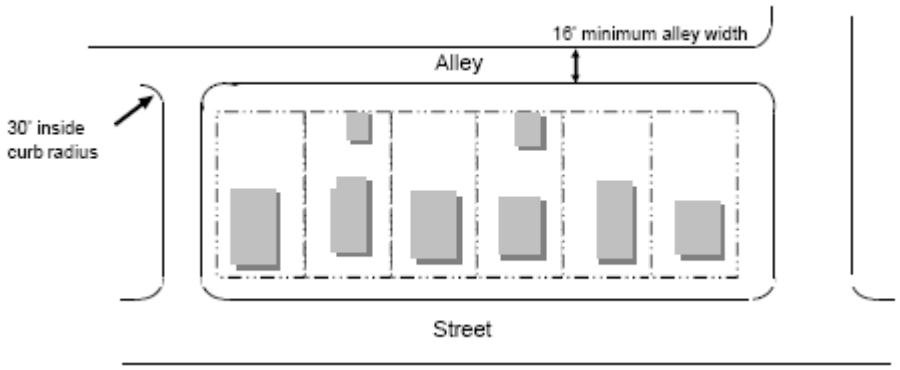
A-5. Access to roll-off collection devices as noted below shall provide 40 feet of clear maneuvering area from the end of the compactor. Access to roll-off device shall not be restricted by any private gate or door, except in accordance with C-5 below, and must meet the standards of A-2 above.

Graphic 14 – A-3 Maneuver Area



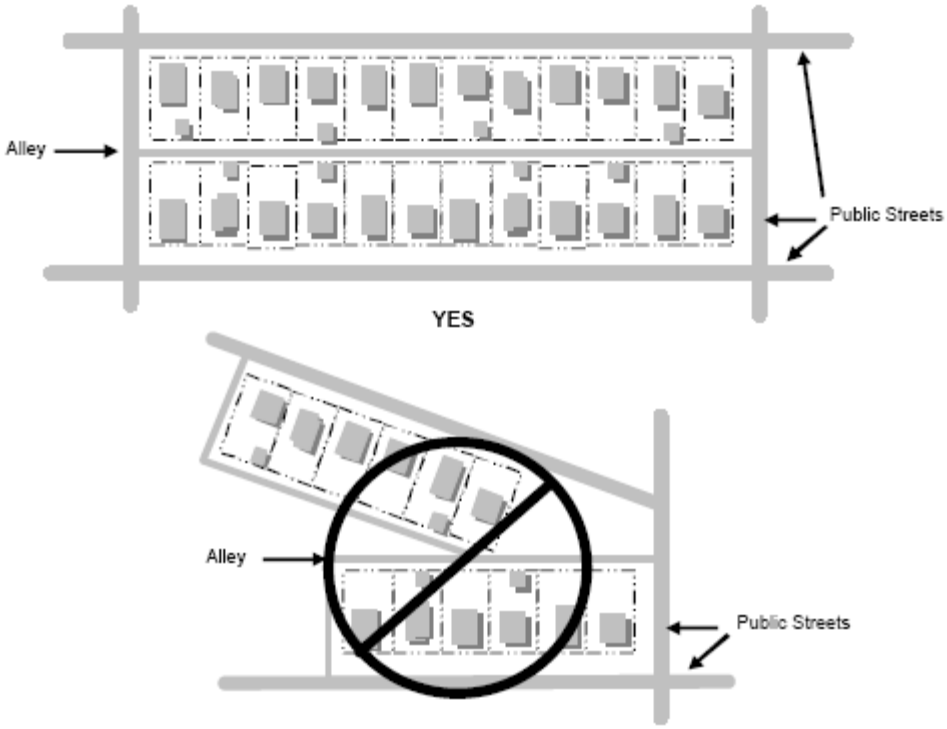
A-6. Alleys used for solid waste collection vehicles that serve individual residential units must be a min. 16’ in width. Inside curb radii must be min. 30’. All alleys to be traversed by solid waste collection vehicles must meet the residential street standard of 8” sub-base and 2.5” asphalt surface course. If being used for soled waste service, the alley must be constructed to public street standards.

Graphic 15 – Alley Access



A-7. Alleys should extend through a block between public streets, and avoid 90- degree or acute angled turns.

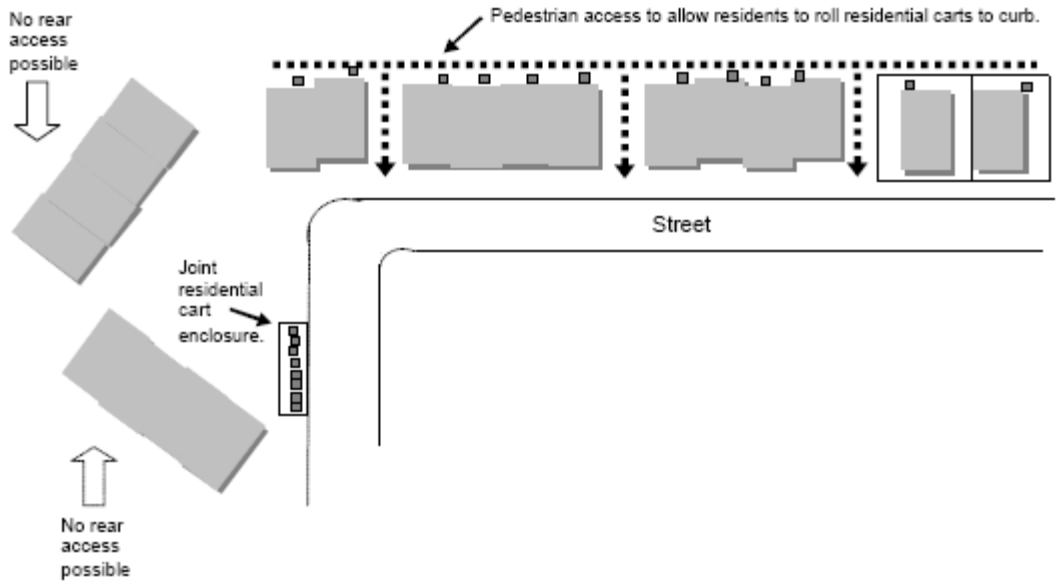
Graphic 16 – Alley Layout



A-8 Where a rear alley is not provided for solid waste vehicle s, direct vehicular access to all small-lot or attached single-family homes (patio home, cluster home or townhome developments) for the purpose of collection of 96-gallon standard City residential solid waste carts must be provided. This access can be provided either (a) by a design that allows each unit occupant to roll the carts to the public or private street as is normal for residential pick-up (no obstructions or topographical features that would hamper the resident from rolling the cart to the curb – at least 3' horizontal clearance); (b) multiple 96-gallon standard City residential solid waste carts may be stored in a common area which is accessible directly to the public or private street; or (c) the development may provide for a common collection

facility (dumpster) in accordance with Section C. below. Any design other than (a), (b) or (c) above must be approved by the Solid Waste Services Director.

Graphic 17 – Residential Access



6.21 Traffic Calming (Pending project approval)

6.22 Street Lights

The City of Raleigh has a streetlight program that strives to provide lighting for all public roads inside the corporate city limits. There are two standards for streetlight design, which are dictated by the roadway type. For roads that are City maintained, the City and property developers must adhere to the lighting standards in Chapter 7 of the UDO . For roads that fall on the State Highway System, lighting standards must adhere to NCDOT's standards.

Streetlights within the City of Raleigh are leased from local energy providers. Standard installation includes an energy efficient Light-Emitting Diode (LED) fixture mounted on 30' a wood pole.

Certain roadway improvement projects may include the installation of streetlights on gray fiberglass poles at city expense. No decorative or pedestrian scale streetlight posts or fixtures are leased by the City of Raleigh outside of City initiated streetscape projects.

6.22.1 Raleigh Ordinance

Below is an excerpt regarding streetlights from the City of Raleigh Code of Ordinances:

UNDERGROUND UTILITIES.

(d) Street Lights.

The developer, when installing underground electrical and telephone service shall also install at his expense underground terminal facilities for street lighting along public streets according to the standards required by the Illuminating Engineering Society publication Road Lighting; provided however, that the average maintained foot-candle (fc) level for outlying and rural roads as defined in said publication shall be no less than three-tenths (0.3) and the uniformity ratio shall be no greater than sixty-four (64). The City will not take responsibility for any street lighting system until it meets the above standards.

1. The developer is responsible for installation of streetlights on all local access system roadways (residential and commercial), which will be built or improved as part of their development project. (.4 fc and 6:1 uniformity)

2. The developer is responsible for installation of streetlights on all collector system roadways (residential and commercial), which will be built or improved as part of their development project. (.6 fc and 4:1 uniformity)

3. The developer is responsible for installation of streetlights on all minor thoroughfare system roadways, which will be built or improved as part of their development project. (.9 fc and 4:1 uniformity). If the roadway is built to State standards the street lighting is subject to State lighting requirements.

4. The developer is responsible for installation of streetlights on all major system roadways, which will be built or improved as part of their development project (1.2 fc and 4:1 uniformity). If the roadway is built to State standards the street lighting is subject to State lighting requirements.

5. The developer is responsible for installation of streetlights on all secondary system roadways, which will be built or improved as part of his development project. If the roadway is built to State standards, the street lighting is subject to State lighting requirements. The City may opt to participate in streetlight installations that would close any gaps in the streetlight system created by this requirement.

6.22.2 Lighting Design Standards for City Maintained Streets:

Table 12 Lighting Design

Street Classification	Average Maintained Foot-Candles	Uniformity

Downtown Mixed Use District	2.0	4:1
Thoroughfare	1.2	4:1
Thoroughfare	.9	4:1
Collector Street	.6	4:1
Residential Streets	.4	6:1

Additional specifications regarding streetlights along City of Raleigh public roadways:

- Energy provider leased Light-Emitting Diode (LED) streetlight fixtures must be used on public right-of-way if they are to be added to the City account. The energy provider will conduct all troubleshooting, repairs, and maintenance.

- The energy provider must develop a lighting plan meeting or exceeding the City of Raleigh lighting standards as stated in Sec. 10-3059 of the City Code of Ordinances. This plan must be approved by Transportation Operations staff before the energy provider is authorized to install.

- The energy provider generally determines the type (wattage) of LED streetlight fixture to be used along each public roadway and the associated pole spacing to meet the City's lighting standards. This can be modified by City staff if need be, and must be approved by staff before installation begins.

- All streetlights must be underground fed, unless overhead infrastructure already exists where streetlights will be placed.

- Underground facility installation and any abnormal costs (trenching, boring, reseeding, rock removal, etc.) associated with streetlight installation must be paid for by the developer, per the *Streetlighting Developer Requirements*.

- In order for the streetlights to be added to the City account, they must be installed on 30' wood or gray fiberglass poles. If gray fiberglass is used, a $250/pole buy down can be paid to the City in order to have the streetlights added to our account. This buy down must be paid before City staff will authorize the installation of gray fiberglass poles.

- If the developer uses any type of black poles, post-top lamp streetlights, or pedestrian scale lighting the streetlights cannot be added to the City's streetlight account. These must remain on a private account. If a state registered non-profit owner's association exists for the development, an agreement can be drafted to allow for the annual reimbursement of city standard lighting costs to the association.

6.23 Traffic Studies

6.23.1 Purpose of Traffic Studies

In order to better serve the public, the City of Raleigh has adopted a set of minimum standards for traffic studies. This document provides guidance to ensure consistency, to make findings more accurate and to maximize confidence in the results. Deviation from these practices requires justification. By reviewing reports, plans, and submittals, the City of Raleigh in no way relieves the traffic engineer of possible claims or additional work resulting from errors or omissions.

The purpose of a Traffic Study is:

- To provide reliable guidance on short- and long-range planning of site access and off-site improvements
- To assist developers and property owners in making critical land use decisions regarding traffic and other modal needs
- To provide government review agencies with recommendations for achieving responsive and consistent transportation and access policies

Development plans and rezoning cases have a burden to prove that the expected increase in trips will not create unsafe or inefficient traffic conditions. If the expected increase in trips does create unsafe or inefficient traffic conditions, the developer must mitigate the traffic impacts. The standard to provide mitigation is when overall intersection or approach level-of-service degrades from LOS-E to LOS-F. Another standard to provide mitigation is when arterial level-of-service degrades from LOS-E to LOS-F. Mitigation may involve changes to signal timings, constructing additional lanes, restricting access, prohibiting left turns or other measures.

Guidance: City staff, in consultation the traffic engineer, will determine the magnitude of mitigation measures on a case-by-case basis.

6.23.2 Initiating Traffic Studies

In considering the transportation aspects of land development, it is important to determine early in the process if and when a traffic study is needed. Not all land development projects warrant a traffic impact analysis; City staff shall determine when trip generation, traffic assessment or traffic impact analysis reports are required.

6.23.3 Land Uses

Traffic impact analyses shall be required for the following land uses:

A. Single Family Residential Developments ≥ 150 Dwellings
B. Apartment Developments ≥ 240 Dwellings
C. Residential Condo/Townhome Developments ≥ 300 Dwellings
D. General Office Buildings ≥ 64,000 sq.ft.
E. Medical Office Buildings ≥ 47,000 sq.ft.
F. Shopping Centers ≥ 23,000 sq.ft.
G. Supermarkets ≥ 20,000 sq.ft.
H. Convenience Market w/ Gas Pumps: 6 or more Fueling Positions*
I. Pharmacy w/ Drive-Thru ≥ 29,000 sq.ft.
J. Drive-In Bank ≥ 11,500 sq.ft.
K. Fast-Food Restaurant w/ Drive-Thru ≥ 6,000 sq.ft.

* Fueling positions are defined as the maximum number of vehicle that can be fueled simultaneously

Guidance: The development intensities listed in Section 6.24.3 are consistent with the estimated volume of new trips on the public street system in Section 6.24.4 after deductions for pass-by trips.

6.23.4 Trip Generation

Traffic impact analyses shall be required for the following trip generation volumes:

A. Peak Hour Trips ≥ 150 veh/hour
B. Peak Hour Trips ≥ 100 veh/hour if primary access is on a 2-lane road
C. More than 100 veh/hour trips in the peak direction
D. Daily Trips ≥ 3,000 veh/day
E. Enrollment increases at public or private schools

Guidance: The volumes listed in Section 6.24.4 are for new trips on the public street system after deductions for pass-by trips and, for mixed-sue developments, internal capture trips.

6.23.5 Site Context

Traffic impact analyses shall be required when the following conditions exist in the vicinity of the development site:

A. Affects a location with a high crash history [Severity Index ≥ 8.4 or a fatal crash within the past three years]
B. Takes place at a highly congested location [volume-to-capacity ratio ≥ 1.0 on both major street approaches]
C. Creates a fourth leg at an existing signalized intersection
D. Exacerbates an already difficult situation such as a RR Crossing, Fire Station Access, School Access, etc.

E. Access is to/from a major arterial roadway such as a Parkway, Multi-Way Boulevard or Multi-Lane Avenue
F. Proposed access is within 1,000 feet of an interchange
G. Involves an existing or proposed median crossover
H. Involves an active roadway construction project
I. Involves a break in controlled access along a corridor

6.34.6 Miscellaneous Applications

Traffic impact analyses shall be required for:

A. Planned Development Districts
B. In response to Raleigh Planning Commission or Raleigh City Council concerns

Guidance: For rezoning applications, the basis of comparison for trip generation thresholds will be the difference between the maximum allowable land use intensity under current zoning compared to the maximum land use intensity under the proposed zoning. For site plans and subdivisions, the basis of comparison for trip generation thresholds should be the difference between trips generated by the site at the time of preliminary plan submittal versus the expected increase in roadway trips upon development of the site.

6.23.7 Study Area

The extent of a traffic study depends on the location and size of the proposed development and the conditions prevailing in the surrounding area. It is recognized that an excessively large study area may unnecessarily increase costs, time and effort for the developer, the traffic engineer and City staff. Alternatively, an inappropriately small traffic study area may fail to include roadway segments and/or intersections that would need to be improved to accommodate the trips generated by a proposed development.

6.23.8 Access Points and Intersections

Any traffic study that analyzes off-site impacts shall include all site access points and major intersections (signalized and unsignalized) adjacent to the site.

Guidance: City staff (with input from the developer's traffic engineer) will determine any additional areas to be included based on local or site-specific conditions, development size or neighborhood sensitivities. The study area boundaries may also be influenced by impacts other than pure capacity issues such as neighborhood cut-thru trips, known congestion issues, accident history, temporary anomalies in the existing roadway system that would influence travel patterns, long-range transportation planning goals, etc.

6.23.9 Traffic Study Scope

It is critical that all parties discuss the traffic study early in the planning process. An understanding as to the level of detail and the assumptions required for analysis will be determined at that time. In addition to learning the study issues, coverage and level of detail, the traffic engineer must obtain and verify the following information:

- Available traffic counts
- Information about available transit, bicycle and pedestrian facilities
- Committed and planned roadway improvements and the schedule for those improvements
- Approved development and background traffic data
- Applicable agency codes and policies
- Existing congestion locations within the study area
- Crash data for all intersections and/or street segments within the study area
- Traffic signal timings
- Committed and planned signal system improvements
- Neighborhood sensitivities
- Other traffic-related issues determined by City staff

Guidance: City staff will assist the traffic engineer in obtaining all information needed to initiate and complete the traffic study.

6.23.10 Traffic Model Analysis Programs

Except for very simple cases, all traffic analyses shall be produced with special software programs that are designed specifically for traffic model applications. For software to be acceptable it must be based on the most current Highway Capacity Manual methods.

6.23.11 Preferred Analysis Programs

Signalized intersection delay	Synchro
Unsignalized intersection delay	Synchro
Queuing and blocking	SimTraffic
Roundabouts	SimTraffic
Simulation	SimTraffic
Actuated signal cycle variables	SimTraffic
Arterial delay	SimTraffic
Arterial travel time	SimTraffic
Arterial speed and Level-of-Service	SimTraffic
Network total stops	SimTraffic
Network stops per vehicle	SimTraffic
Network fuel consumed	SimTraffic
Network air quality/vehicle emissions	SimTraffic
Multimodal Level-of-Service	Artplan

Guidance: Use of alternate analysis software must be approved by City staff; however the above software is not specifically endorsed by City staff. Other traffic analysis tools and programs will be considered on a case-by-case basis. City staff shall determine the appropriateness of the alternative models.

6.23.12 Existing Conditions

Once all information listed in the study scope has been obtained, it is used to create an existing conditions traffic model. The existing conditions model will be used to create a foundation for assessing the land use and traffic impact changes over time. Thus it is critical that the existing conditions model be as accurate as possible.

6.23.13 Existing Conditions Data Requirements

Traffic volumes shall reflect normal weekday and/or peak hour traffic conditions. When submitting a traffic study document for review, the traffic counts used for capacity analysis purposes shall have been taken no more than one year prior to the submittal date of the document. Exceptions to this standard can be approved on a case-by-case basis. In some cases, it is necessary to conduct new traffic counts. Counts shall not be taken on holidays, when school is not in session, during adverse weather or when special events occur. The existing conditions model shall accurately reflect the current street and traffic control environment including, but not limited to:

- Road geometry
- Number and type of travel lanes
- Auxiliary turning lanes, storage lengths and tapers
- Medians and two-way left turn lanes
- Traffic volumes, including heavy vehicles and pedestrians
- Transit stops, exclusive bicycle lanes and on-street parking (when applicable)
- Cycle length, signal offsets, splits and phase sequence
- Detector layout and detector settings
- Phase settings such as recall mode, volume-density settings, minimum green, maximum green and clearance times
- Two-way and all-way stop control
- Roundabouts and other unconventional intersections

Guidance: City staff will assist the traffic engineer in obtaining turning movement counts, existing signal plans and current signal timings from City of Raleigh archives.

6.23.14 Non-Site Traffic Forecast

Estimates of non-site traffic are required to complete the analysis of horizon year conditions. Non-site traffic volumes, when added to existing volumes, are typically known as Background Traffic. These estimates characterize the “base” conditions, i.e., traffic conditions prior to a site being redeveloped. Non-site traffic consists of two components: existing traffic volumes projected forward to the horizon year using an annual grow rate and trips generated by approved developments within or adjacent to the study area.

Projections of existing traffic volumes to the horizon year are dependent on an assumed annual growth rate. City staff (with input from the developer's traffic engineer) will determine the appropriate growth rate based on information such as the Triangle Regional Traffic model, historical daily traffic volumes obtained from NCDOT, existing turning movement counts, previous traffic studies or other sources.

Guidance: City staff will provide any necessary information on approved development trips within the study area.

6.23.15 Site Traffic Generation

The ITE *Trip Generation Manual* (latest edition) shall be used to compute Daily, AM peak and PM peak period trips for each land use. At the discretion of City staff, locally obtained trip generation data can be substituted. The ITE *Trip Generation Handbook* (latest edition) method shall be used to select between trip generation average rates and equations.

Trip generation for individual outparcels shall be calculated separately from the remainder of the development. Some land uses require additional justification or local studies. For example, the use of Specialty Retail shall include definite plans for the specific retail that will be in place.

6.23.16 Internal Capture Trips

Internal capture calculations shall be used cautiously. The internal capture calculations shall utilize the percentages from the ITE *Trip Generation Handbook* (latest edition) to estimate the internal capture reduction percentage. Alternatively, the National Cooperative Highway Research Program Report 684 *Enhancing Internal Trip Capture Estimates for Mixed-Use Developments* can be used with concurrence of City staff.

Reductions for internal capture shall be applied to multi- or mixed-use sites only. Internal capture shall not be taken for AM peak hours or from lodging land uses without prior approval by city staff. Internal capture procedures shall not be used on a retail-only site. The internal capture reduction shall be applied before the pass-by trips are calculated.

6.23.17 Pass-by Trips

Pass-by percentages shall be obtained from the ITE *Trip Generation Handbook* (latest edition). Pass-by percentages shall only be applied to land uses numbered in the 800s and 900s. For multi-use developments, pass-by percentages shall be applied to the retail component only. Pass-by trips shall not exceed 10% of the total volume on the adjacent street.

6.23.18 Alternative Mode Trips

Increasingly, site trips are made by alternative modes such as transit, bikes and walking; City staff recognizes this trend. Reductions in passenger car trips due to alternative modes will be considered, case-by-case, provided that the rationale behind the reduction is clearly stated and evidence or data to support the reduction is reviewed and approved by City staff.

6.23.19 Site Traffic Distribution and Assignment

The expected volume of trips generated by a development must be distributed and assigned to the roadway network so that traffic impacts on intersections and street segments can be analyzed and quantified. Site traffic distribution shall be based on clearly stated assumptions and the rationale behind those assumptions. Primary trip distribution shall be based on a gravity model. Pass-by trips shall follow the existing volume distribution of the primary access road.

Guidance: All efforts should be made to ensure that upstream and downstream traffic volumes along corridors balance and maintain continuity. If balanced volumes are not attainable, explanation must be provided. Documentation regarding the balancing methodology must be provided in the technical appendices.

6.23.20 Analysis

Analyses shall be submitted for each of the following scenarios:

Table 13: Analysis Scenarios

Scenario	Rezoning	Site Plan/Other
Existing Year	Yes	Yes
Background/Horizon Year	Yes	Yes
Build-out under current zoning	Yes	Yes
Build-out under proposed zoning	Yes	No
Build-out in phases	No	Yes
Build-out with proposed mitigation	No	Yes

6.23.21 Measures of Effectiveness

When performing analyses, providing overall intersection Level-of-Service alone is not sufficient. Items such as queuing, approach level of service, and volume–to-capacity ratio for example shall also be evaluated. The measures of effectiveness listed in Table 2 shall be used for all traffic studies unless waived by City staff.

Table 14: Intersection, Arterial and Network Measures of Effectiveness

Signalized intersection	Intersection average delay per vehicle
	Intersection level-of-service
	Approach average delay per vehicle
	Approach level-of-service
	Movement volume
	Percent of cycles maxed out (by phase)
	Maximum observed queue length
	Average queue length
	Upstream block time (%)
	Storage block time (%)
	Volume-to-capacity ratio (by phase)
	Intersection vehicle hours of delay
Unsignalized intersection	Movement delay
	Movement level-of-service
	Movement maximum queue length
Arterial	Delay
	Travel time
	Speed
	Level-of-Service
Network	Stops per vehicle
	Fuel consumed
	Overall delay
	Air quality/vehicle emissions
	Multimodal Level-of-Service

Guidance: Measures of effectiveness for isolated intersections, all intersections along a particular road or all intersections within a roadway network can provide important information when evaluating transportation and land use alternatives. Network and Arterial MOEs are not appropriate for every study. City staff will determine the appropriate measures of effectiveness for each traffic study on a case-by-case basis.

6.23.22 Traffic Analysis Default Values

The existing cycle length, signal offsets, splits and phasing scheme for all traffic signals within the study area shall be maintained for all analysis scenarios. Traffic models shall match the signal plans with respect to detector size, detector location and all other detector settings unless it can be demonstrated that the detectors have been field adjusted to other values. All nodes and links within the traffic models shall be accurately located based on NC Grid Coordinates.

Microsimulation programs, such as SimTraffic, shall use a seed time of 10 - 15 minutes and a recording time of 60 minutes. The resulting performance measures shall be averaged over at least 10 simulation runs.

Under **Options** → **Intervals and Volumes** set the SimTraffic Parameters as follows:

Table 15: Simulation Settings

Intervals	**0**	**1**	**2**	**3**	**4**
Interval Name	Seeding	Grow	Peak	Stabilize	Recover
Duration (minutes)	10 - 15	15	15	15	15
Record Statistics	No	Yes	Yes	Yes	Yes
Growth Factor Adjust	No	No	No	No	No
PHF Adjust	No	No	Yes	No	No
Anti-PHF Adjust	No	Yes	No	Yes	Yes

The Base Saturation Flow Rate shall be used in accordance with the Highway Capacity Manual (latest edition). Lane Utilization Factors shall be used in accordance with the Highway Capacity Manual (latest edition). A Peak Hour Factor (PHF) of 0.90 shall be used. If traffic counts have been acquired, the resulting PHF may be used for existing and projected conditions. Where schools are present, a PHF of 0.50 shall be used for the AM peak period.

Under the traffic model's simulation settings, change **Enter Blocked Intersections** to Yes for the major street approaches to all unsignalized intersections.

Guidance: The seeding interval should be set to a minimum of 10 minutes or the length of time required for a vehicle to traverse the entire network (including stop time) whichever is greater.

6.23.23 Traffic Impact Mitigation Measures

If a proposed mitigation involves changing the cycle length, phase duration, phase sequence, splits or offsets of any traffic signal then the traffic engineer will be required to meet personally with Public Works staff in the Raleigh Traffic Control Center. The traffic engineer must demonstrate to Public Works staff's satisfaction that their proposed signal changes will not have unacceptable adverse impacts on other intersections or signals. Public Works staff will determine the area to be considered and the extent of the signal network to be studied. Public Works staff will determine the quality and quantity of information necessary to evaluate the proposed signal timing plan. Once Public Works staff has met with the developer's traffic engineer, staff will have five business days to decide if they will accept or not accept the proposed signal changes. City staff will reply to the traffic engineer in writing and either state explicitly that the proposed changes are acceptable or explain why the proposed signal changes were rejected.

Recommended storage lane lengths shall be provided for all exclusive turn lanes. The 95th percentile queue from a deterministic model or the maximum observed queue from a simulation (whichever is larger) shall be used to determine the storage lane length. Queuing shall not exceed the storage capacity of the approach. Full storage for queue lengths shall be rounded up to the nearest 25 feet with a minimum of 100 feet for both right-turn and left-turn lanes. A default taper length of 100 feet shall be modeled for all added lanes unless specific taper lengths are known.

6.23.24 Traffic Study Report

The submitted traffic analysis document shall include, but is not limited to: a summary of the analysis and results, site plans, traffic counts and forecasts, volume generation, any assumptions used in the analysis, and any variations from these guidelines. It shall be signed and sealed by a Professional Engineer who is licensed to practice engineering in North Carolina. To facilitate examination by City staff and other interested parties, a one- or two-page executive summary that concisely summarizes the study purpose, findings and conclusions shall be provided.

The traffic study report shall include all current signal timing and signal offset data, obtained from the Raleigh Traffic Operations Center or NCDOT, in the technical appendices.

The traffic study report shall show a side-by-side comparison of Background traffic performance measures at the network, arterial, intersection and approach levels to Build-Out performance measures. The report shall quantify and qualify the changes in magnitude. It will identify which traffic impacts are directly attributable to the development and discuss them in the body of the report.

6.23.25 Multimodal Analysis

All traffic studies shall include a section on Multimodal Level of Service (MMLOS). City Staff will provide information on obtaining software to automate the MMLOS analysis. The traffic engineer will provide an assessment and discussion of current MMLOS conditions in the body of the report as well as a description of how the proposed development will advance Multimodal Level of Service.

6.23.26 Accident History

The traffic study report shall include a section on the accident history of study area intersections and/or street segments. It must assess the number and types of accidents that have occurred in the past three years; it must evaluate the accident severity. If any of the study intersections have a high Severity Index, i.e., greater than 8.40, the report shall discuss possible countermeasures.

The North Carolina Department of Transportation maintains a database of all reported accidents that occur within the state. NCDOT has developed special software known as TEAAS[1] to analyze and report on crashes that occur on roadway segments. TEAAS reports shall be included in the technical appendices. City staff will assist the traffic engineer in obtaining TEAAS reports from NCDOT.

6.23.27 Traffic Study Conclusion and Recommendations

The traffic study report is to be an objective, technical analysis. All conclusions and recommendations shall be based solely on information contained within the report; all findings shall be clearly documented. It is acceptable to cite publications within the public realm such as the *Manual on Uniform Traffic Control*

[1] Traffic Engineering Accident Analysis Software

Devices, the AASHTO *Highway Safety Manual*, Federal Highway Administration reports, etc. in order to provide supporting evidence or to articulate key points provided that the citation includes the title, section/chapter and page number of the reference source.

The analyses shall be presented in a straightforward and logical sequence. The analyses shall lead the reader step-by-step through the various stages of the process to the resulting conclusion and recommendations. Sufficient detail shall be included so that City staff will be able to follow the rationale and methodology of the analysis.

Whenever possible, data should be presented in tables, graphs, maps and diagrams rather than narrative text. When appropriate, schematics drawings of roadway improvements, such as intersection reconfigurations, may be included and described in the text. Since the report may be read by nontechnical decision-makers and interested citizens, it should be as concise as possible with a minimum of jargon.

Recommendations where mitigation or improvements are identified "by others" shall clarify which parties are to provide the additional improvements. The traffic study report shall provide documentation that those parties have agreed to construct the additional improvements. The study shall not use planned, but unfunded improvements, by government agencies as a means of mitigation.

The traffic study report shall not include political views or statements, nor shall it take an advocacy position.

Guidance: City staff reserves the right to impose additional conditions and to ask for additional information during the course of the review if warranted by obvious concerns over possible traffic impacts on adjacent properties, roads or intersections. Inadequate reports will be returned to the traffic engineer for completion or modification. In such cases, City staff will state in writing the report's deficiencies and will provide direction for addressing those deficiencies.

6.23.28 Traffic Study Submittal Requirements

Submit all traffic model data files, a pdf file of the traffic study report [including appendices] and two bound copies of the traffic study report directly to:

City of Raleigh, Office of Transportation Planning
One Exchange Plaza, Suite 727
Raleigh, NC 27601

City staff will acknowledge receipt of the report via email within 24 hours. Until acknowledged by City staff, the report has not been **officially** received.

Guidance: Staff's preference is that one hard copy contains the body of the report and the second hard copy contains both the body and the technical appendix.

6.24 Bicycle Infrastructure

6.24.1 Bike Parking Standards

A. Standard U-Rack Design Detail

Distance to other Racks:

- Racks aligned parallel to each other (side by side) must be at least 36 inches (3ft) apart.
- Rack units aligned end to end must be at least 96 inches (8ft) apart.

Distance from a Curb:

- Rack units placed perpendicular to the curb must be at least 48 inches (4ft) from the curb to the nearest vertical component of the rack.
- Rack units placed parallel to the curb must be at least 24 (2ft) inches from the curb.

Distance from Wall:

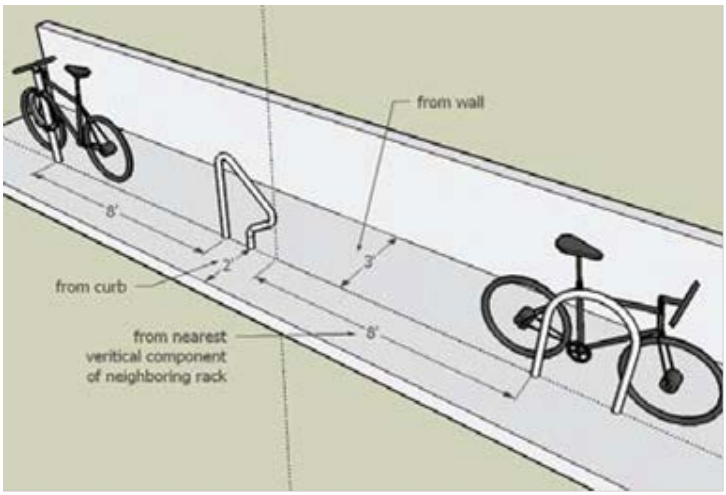
- Rack units placed perpendicular to a wall must be at least 48 inches (4ft) from the wall to the nearest vertical component of the rack.
- Rack units placed parallel to a wall must be at least 36 inches (3ft) from the rack to the wall.

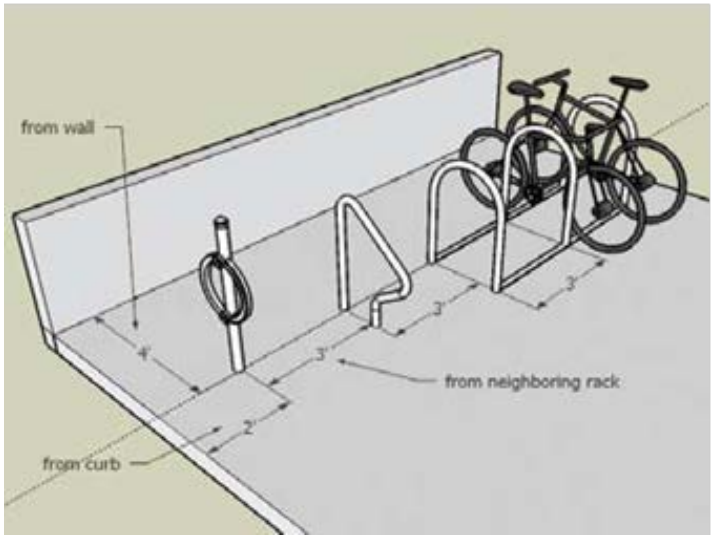
Other Distances:

- Allow at least 48 inches (4ft) for safe pedestrian clearance
- Racks should be placed 6 inches off of brick pavers or tree grates
- Racks should line up with existing infrastructure (tree grates, existing racks, benches, etc)

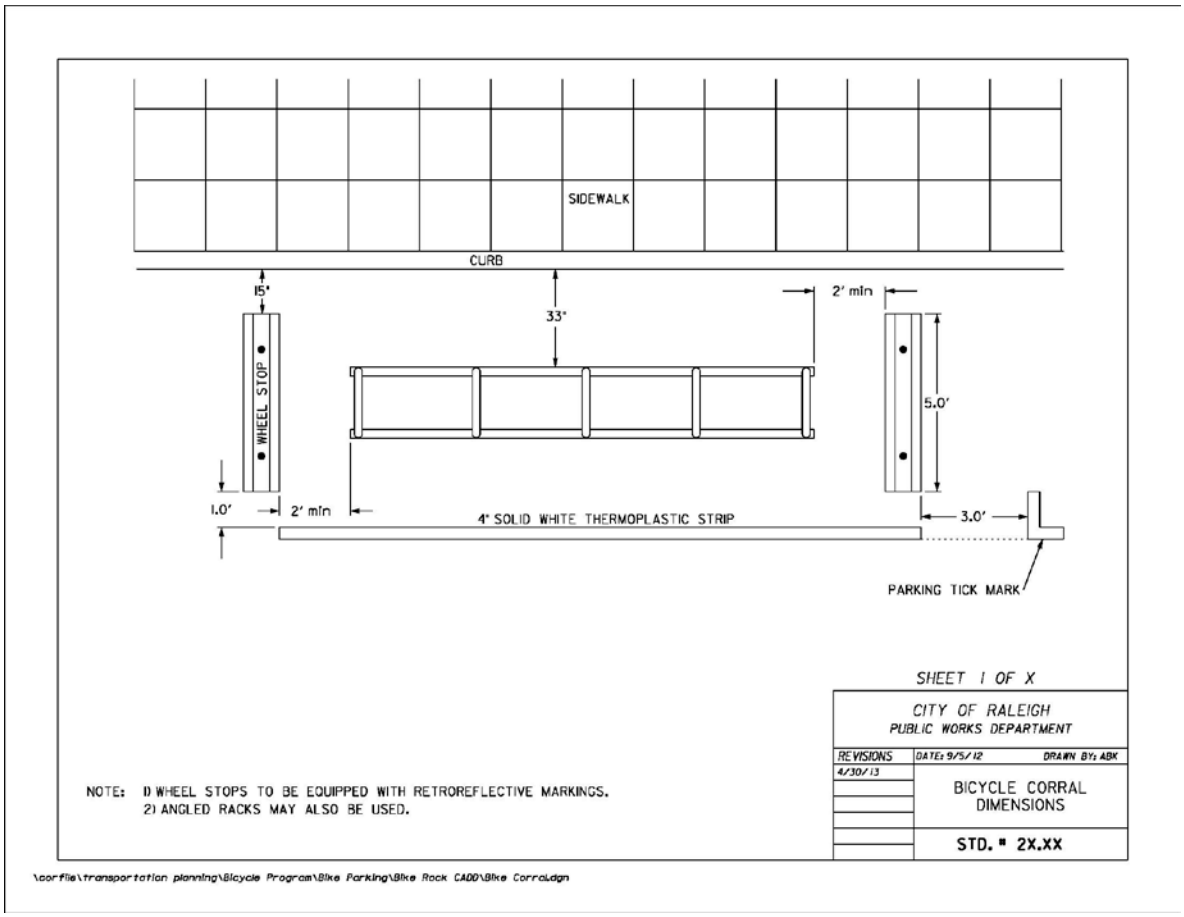
Insert Design Detail
Insert Example photo of u-rack

Example Detail Graphics:





B. On-Street Bike Corral



Insert photo of bike corral

C. Covered Bike Parking Design Standards

Insert Design Detail
Insert Example photo of covered bike parking

6.24.2 On-road Bicycle Facility Design Standards

A. Bicycle Lanes

Definition: A portion of the roadway that has been designated by pavement markings for the preferential and exclusive use of bicyclists. Bicycle Lanes are always located on both sides of the roadway and carry bicyclists in the same direction as motor vehicle traffic. The minimum width for a bicycle lane is five feet.

Design Standards:

- The minimum width for a bicycle lane is five feet
- Symbols should be placed on the far side of every intersection, or decision point and/or intervals of 300ft—whichever comes first
- Minimum width next to on-street parking is five feet with a two foot buffer
- Bike lane should be dropped XX feet before intersection with shared right/through lane

- Mini skips should be placed whenever a bike lane is dropped; skips should be a 50ft in length
- Bike lane between a through lane and a right turn lane
- Buffered bike lanes
- Bike lane should break for asphalt driveways, entrances or street crossings
- Bike lane should continue across concrete driveways or commercial entrances

**Insert Design Details for: **
Bike Lane at intersection,
Bike lane next to on-street parking,
Bike lane between through/right turns,
Bike lane across driveways
Insert Example photo of bicycle facilities

B Shared Lane Markings

Definition: Shared lane markings are used on roadways where dedicated bicycle lanes are desirable but not possible due to physical or other constraints. Placed every 250-feet, shared lane markings make motorists more aware of the potential presence of cyclists; direct cyclists to ride in the proper direction; and remind cyclists to ride further from parked cars to avoid 'dooring' collisions.

Design Standards:

- Sharrows should be placed at every decision point or at intervals of 250 feet, whichever occurs first
- When no on-street parking is present, sharrows should be placed four feet from the face of the curb
- When on-street parking is present, sharrows should be placed:
  - -Travel lane is greater than or equal to 14 ft, sharrow is placed 11 ft from face of curb
  - -Travel lane is less than 14 ft; sharrow is placed in the center of the travel lane

**Insert Design Details for: **
Sharrow placements: with and without on-street parking ,
Insert Example photo of sharrow

C. Paved Shoulders:

Definition: Paved shoulders are part of the roadway, which is contiguous, and on the same level as the regularly traveled portion of the roadway. The minimum width for paved shoulders is four feet.

**Insert Design Detail **
Insert Example photo of paved shoulder

D. Wide Outside Lanes

Definition: A wide outside lane refers to the through lane closest to the curb and gutter of the roadway. The minimum lane width to accommodate both motorists and bicyclist is 14 feet.

**Insert Design Detail **

Insert Example photo of wide outside lane

7.0 Construction and Details (standard detail drawings addendum)

8.0 Glossary

AASHTO: The American Association of State Highway Transportation Officials.

Access Point: A point of ingress and/or egress, which connects a development to a public or private street.

Capacity: The maximum sustainable hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform segment of a lane or roadway during a given time period under prevailing traffic, roadway and control conditions.

Coordination (signal): Maintaining a predictable time relationship between the operation of a traffic signal relative to the operation of other signals in a group or system.

Cycle Length: The time elapsed between the endings of two sequential terminations of a given interval. For coordinated signals, this is measured by using the coordinated phase green interval.

Detector: A device used to sense the presence or absence of vehicles or pedestrians in the vicinity of a signalized intersection.

Detector Settings: Controls used to affect the operation of a detector.

Developer: A site planner, landowner or subdivider.

Development/Development Plan: Any site plan or subdivision plan.

Green Interval: The duration of the green indication for a given movement at a signalized intersection.

Internal Capture Trip: A trip made within the confines of a mixed use development that does not use the off-site street system.

ITE: The Institute of Transportation Engineers

Level-of-Service (LOS): A quantitative stratification of a performance measure or measures that represent quality of service, measured on an A – F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst.

Measures of effectiveness (MOEs): are measureable quantities and characteristics used to compare traffic impacts from various alternatives. Measures of effectiveness quantify traffic impacts and allow for an objective examination of the results. Traffic impacts can be quantified in a variety of ways such as delay, queuing or average speed and at different scales. In many instances, the specific quantity for a given MOE is

not as significant as the relative change of in MOE quantity between different alternatives. “Scale” refers to impacts for a specific area under review: an isolated intersection, all intersections along a particular road or all intersections within a roadway network.

Mixed Use Development: A single real estate project that consists of two or more land use classifications between which trips can be made without using the off-site street system.

Mitigation: Alleviation, reduction, abatement or diminution of traffic impacts created by a development.

Multimodal: Being used by more than one travel mode such as motor vehicles, pedestrians and bicycles.

Multimodal Level-of-Service (MMLOS): A type of analysis where the level-of-service of each travel mode on a facility is evaluated simultaneously.

Offset: The time that the reference phase of a traffic signal begins (or ends) relative to the system master time zero.

Pass-by Trip: A trip made as an intermediate stop from an origin to a destination that does not require a route diversion.

Phase (signal): The part of the signal cycle allocated to any combination of traffic movements receiving the right-of-way simultaneously during one or more intervals. A phase includes the green, yellow change, and red clearance intervals.

Phase Sequence: (1) The sequence of service provided to each traffic movement. (2) A description of the order in which left-turn movements are served relative to the through movements.

Phase Settings: Controls used to influence the start, duration and ending of a signal phase.

Primary Trip: A trip made for the specific purpose of visiting a destination. Stopping at the destination is the primary reason for the trip.

Reference Phase: One of the two coordinated phases of a traffic signal.

Roundabout: An unsignalized intersection with a generally circular shape, characterized by yield on entry and circulation around a central island.

Shall: As used in the context of traffic studies, shall indicates a mandatory action, procedure or practice.

Shopping Center: A planned, unified development which contains at least three (3) retail or recreational establishments within a minimum of twenty-five thousand (25,000) square feet of floor area gross on a land area of at least two and one-half (2.5) areas in size.

Should: As used in the context of traffic studies, should indicates a mandatory action, procedure or practice that City staff is empowered to waive.

Split: The segment of the cycle length allocated to each phase or interval that may occur. In an actuated controller unit, split is the time in the cycle allocated to a phase – the sum of the green, yellow change, and red clearance intervals for a phase.

Street: A general term for denoting a public way for purposes of pedestrian, bike and vehicular travel, including the entire area within the right-of-way.

Trip: Travel between an origin and a destination.

Traffic Engineer: A professional engineer who is licensed by the North Carolina Board of Examiners for Engineers and Surveyors to practice engineering and who has special knowledge of traffic engineering principles through a combination of education, training and experience.

Traffic Engineering: The application of scientific and mathematical principles to facilitate the safe and efficient movement of people, goods and information.

Traffic Impact: A measurable, quantifiable or qualified effect on one or more traffic performance measures. Traffic impacts can be beneficial or detrimental.

Traffic Performance Measures: Synonymous with Measures of Effectiveness

Traffic Study: A collective term for Trip Generation Reports, Traffic Assessment Report or Traffic Impact Analysis Reports (see below).

I. *Trip Generation Report*: Calculates the expected number of new trips that a development will generate during the AM and PM peak periods. Trip generation reports are required for all rezoning cases. Exceptions can be made for rezoning cases that do not affect the trip generation characteristics of the property such as tree conservation areas, stormwater retention, location and size of building signs, etc.

II. *Traffic Assessment (TA) Report*: Calculates the expected number of new trips and calculates the current amount of delay, queuing and traffic capacity available at the nearest intersection(s). If existing delays and volume-to-capacity ratios are low, City staff may conclude that the adjacent roadway network can absorb new trips without becoming congested. In that case, no further study is needed.

III. *Traffic Impact Analysis (TIA) Report*: Calculates the expected number of new trips and calculates the current amount of delay, queuing and traffic capacity available at the nearest intersections. TIAs calculate the amount of delay, queuing and volume-to-capacity ratio and other variables both before and after a development is built. City staff will then use engineering judgment to determine if the developers should mitigate some of the traffic impacts from their development by adding a new turn lane or installing some other improvement. If mitigation is recommended, the TIA shall recalculate the traffic impacts after the mitigation measures have been installed. It will quantify

those impacts that can be directly attributed to the new development and the effect of any mitigation.